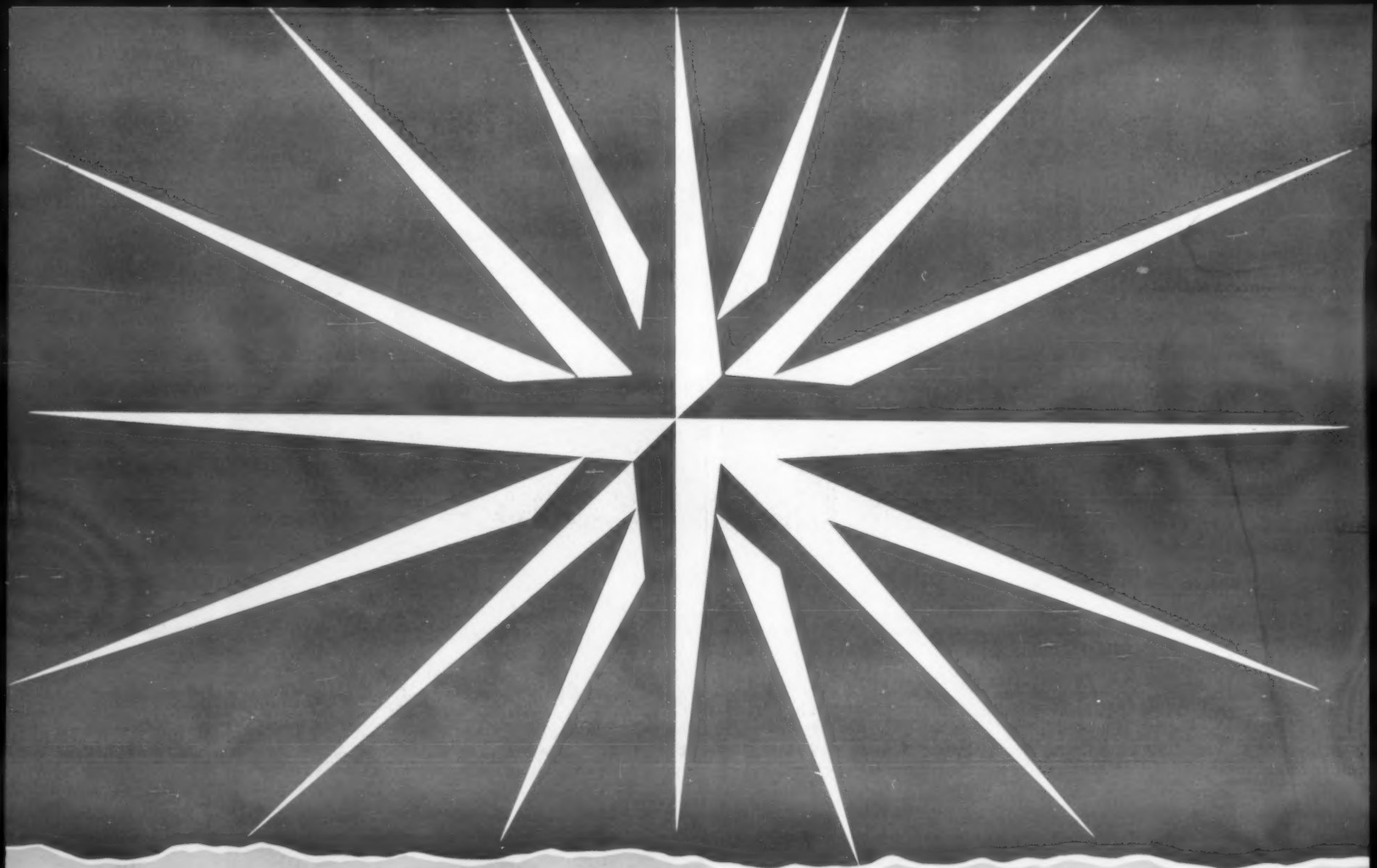
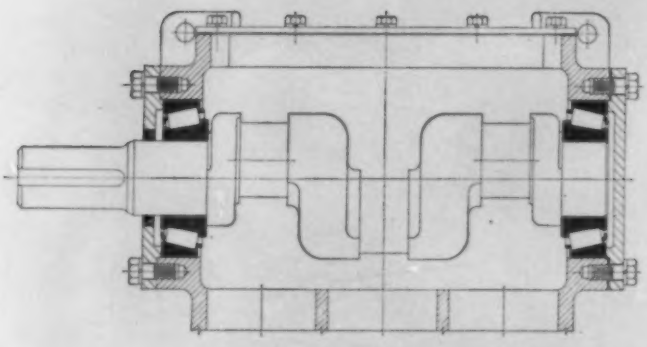


# THE OIL AND GAS JOURNAL

DECEMBER 22, 1958

# New pump uses TIMKEN® bearings to get more capacity in less space, at lower cost



How **WORTHINGTON CORPORATION** mounts the crankshaft of its KCA waterflood pump on capacity-packed, space-saving Timken bearings to take heavy loads, assure dependable performance.

THIS new Worthington KCA waterflood pump is a real do-it-itself worker. It runs unattended, keeping pressure up day-in-and-day-out, under constant, heavy loads.

To keep design compact and economical, yet able to take the heavy loads, engineers selected Timken® tapered roller bearings for mounting the crankshaft. Compared to other types of bearings, they found Timken bearings gave them the higher capacity needed, in less space, and at lower cost.

Their tapered construction lets Timken bearings take both radial and thrust loads. And full-line contact between rollers and races gives Timken bearings the extra load-carrying capacity so vital in rugged oil field pumping. Crankshafts stay positively aligned; pumps work steadily, efficiently—with Timken bearings.

Because these capacity-packed Timken bearings can take greater loads—size for size than other types of bearings, designs can be simpler, more compact. Costs can be reduced. And because Timken bearings keep shafts concentric with the housing, closures are more effective. Dirt stays out, lubricant in, pump maintenance down.

And Timken bearings save power because they practically eliminate friction; they *roll* the loads. They're geometrically designed and precision-made to roll true. We even make our own electric furnace fine alloy steel for Timken bearings. No other American bearing maker takes this extra quality step.

Timken bearings make machines better. And better machines do better work. That's Better-ness. Look for its symbol, bearings trade-marked "TIMKEN", on the machines you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable: "TIMROSCO".

*This symbol on a product means its bearings are the best.*

BETTER-ness rolls on **TIMKEN**® tapered roller bearings

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Dec. 22, 1958

The signs are good for '59:

Oil economists see a brighter picture for the industry based on an expected brisk upturn in business and industry generally.

Talks with economists throughout the industry give this composite of their thinking:

...Total domestic petroleum demand should make gains ranging from 3.8 to 6%.

...Gasoline demand should increase in a range from 3.5 to 4.2%.

...Gross national product will average between $457 and $467 billion and the Federal Reserve Board Index of industrial activity should average between 141 and 152.

These gains should filter through to perk up exploration, drilling, and sales of equipment, services, supplies (p. 51).

▼ ▼ ▼

Top problem of 1959: Halting the rising costs of finding and developing oil.

That's the way Continental President McCollum sees the new year. He says these costs have risen 8% annually, thus outstripping crude-price advances.

His general 1959 outlook: Petroleum demand up 4-5%, production up 7%, refinery runs up 5-6%. Product prices should return to more satisfactory levels if the industry uses common sense in inventory management. McCollum says inventory drawdown was the top achievement in 1958.

▼ ▼ ▼

OCAW is building up pressure on the Gulf Coast to force a showdown shortly after the New Year on its stalled wage drive.

Twenty-five of the 35 bargaining units on the coast have voted to give union leaders authority to call strikes. All the votes have won about 90% approval from workers.

Among the last units to hold a strike vote was that at Petro-Tex Chemical, Houston, the only company which has made a wage proposal in the gulf area. The offer was an increase of about 10.5 cents an hour or 4%. The union turned it down and then took a strike vote.

The tax bogey will rise to haunt oil when legislatures convene early next month. Early hints of what may come are heard in:

...Oklahoma where tax officials are studying plans for an ad valorem tax on crude oil. If approved it would replace a gross production tax. Income from this levy was recently cut when a court held it should not apply to trucking costs.

...Texas where an effort will be revived to impose a husky tax on gas leaving the state. This is a perennial effort but will be hotter this year because of the state's dire need for revenues.

Texas needs about $100 million a year in new revenue to balance its budget. State has lost about $40 million in 2 years in oil severance-tax income. Depressing effects of imports on Texas oil production are blamed for the drop.

The U. S. Treasury Department is ready to oppose efforts in the new Congress to cut the 27½% depletion allowance.

David A. Lindsay of the Treasury's legal advisory staff, recently threw cold water on the National Oil Marketers Association drive to reduce or abolish percentage depletion.

But Lindsay warned: The present rate has been in effect since 1926 and has come to be reflected in many practices and valuations used in the oil and gas industry. Any change in the rate would call for careful consideration of all its consequences.

But percentage depletion picked up opposition from an unexpected source, the new Democratic senator from Alaska.

Ernest Gruening told a news conference in Washington he thinks depletion allowance should be reduced. In almost same breath, the senator-elect spoke in glowing terms of his state's future prospects as a major oil producer, even without the exploration incentive provided by the present depletion rate.

▼ ▼ ▼

An organized wildcatting campaign is getting started in Northeastern Oklahoma's Craig and Mayes counties.

Some 35 wildcats are being planned on the 100,000 acres put under lease in the past few months by independents and majors alike (p. 93).

Prime target of the drilling will be the Arbuckle which ranges down to 2,100 ft. Earlier drilling in this region has aimed principally at the Mississippian. Few wells have gone deeper than 1,500 or 1,600 ft.

The new Oklahoma play is part of a 1958 trend which saw new plays in old places, such as Ohio, Kentucky, New York, Pennsylvania, and Mississippi, often with excellent results.

Explorationists are betting that British Columbia will provide some hot wildcatting news next year.

Area is shaping up as one of Canada's hottest oil-hunting grounds.

Pan American pointed this up by applying for 12,500,000 acres of permit rights in a remote area. The acreage lies northeast of Prince Rupert in the Stikine River basin. It brings Pan American's total holdings in British Columbia to 16,000,000 acres (p. 100).

A rash of new drilling is breaking a lull in sparsely drilled far-southwestern Texas.

Most significant of the wildcats is a well projected to 17,000 ft. by Shell in northern Val Verde County. It will draw attention to this region early in the new year.

A substantial discovery is in the making for Northwest Kansas, the nation's newest oil province.

The R. G. Lawton 1 Rueb just east of the Colorado line swabbed 30 bbl. per hour on test of Lansing-Kansas City at 4,515-25 and 4,537-44 ft.

The test is on the west edge of the Las Animas Arch and is the fourth new pool for the region this year. The virgin province has a great future and you can bet on a bustling wildcat campaign developing there soon rivaling that of the northwestern Anadarko basin.

▼ ▼ ▼

Tennessee Gas Transmission is reorganizing its corporate structure to handle more easily its varied activities.

The result is three new subsidiaries: Tennessee Gas Pipeline Co. to operate the pipeline system; Tennessee Gas & Oil Co. to operate oil and gas exploration and production; and Bay Petroleum Co. to handle refining and marketing.

TGT, meanwhile, has doubled its holdings in Ecuador with purchase of Santiago Petroleum Corp. The $1.7 million deal gives TGT 1,530,000 acres of concessions including Cautivo-Tigre field and a 1,700-bbl. daily topping plant.

Dodecene, a component used in making detergents, has made its first long trip by pipeline.

Continental Oil shipped the petrochemical 500 miles over Cherokee Pipe Line from Ponca City to Wood River and from there by barge to its Lake Charles refinery for more processing.

The pipeline-barge movement offers much lower transportation costs than tank cars which formerly were used (p. 39).

Cost of pipeline right-of-way always is an interesting topic among pipeliners. Price often depends on how much time a company has to haggle.

Trend of prices was outlined for Tulsa Pipe Liners Club by Sinclair's Fred A. Crane.

He says Sinclair was able to get right-of-way for 300 miles of trunk line in Texas for $1 per rod ($320 per mile) over a period of 2 years.

Prices for gathering line run 25 to 50 cents a rod. In congested areas, it's sometimes better to buy land in fee than to get an easement.

▼ ▼ ▼

The Borden Commission report has been raked over the coals by the Canadian Petroleum Association in a special report to Ottawa.

CPA warned the government against excessive regulations upon the nation's resources industries. They would tarnish the present attractiveness of Canada for foreign investments.

The oil association instead advised: Keep policy-making power in the Government not in a board; make the energy board advisory; let Transport Board have regulatory powers; and expedite action on gas-export requests to prevent delays.

▼ ▼ ▼

Crude-price cuts are continuing in Kansas and the Denver basin. More adjustments probably are still to come.

The Texas Co. and Cooperative Refinery have cut Kansas crude 10 cents to a new top of $3.05 a barrel. Continental cut 7 cents to a $3.08 top. The changes involve 45,000 bbl. daily and reflect a move by Kansas buyers to make their prices competitive with lower postings in Oklahoma.

Sinclair reduced its price for Denver-Julesburg crude by 5 cents a barrel to a $2.93 top. The new schedule meets an earlier cut by competition.

Total demand for crude and products is nearing record.

The demand topped 11 million barrels daily for week ended December 12. This is highest average since January 1957 when winter weather combined with the Suez crisis to set new demand records.

The economy car won't be ignored.

American Motors is still making a big sales splash with its Rambler. Its ranking is climbing fast.

The Rambler ranked twelfth among U. S. cars for the first 10 months of 1957. It climbed to seventh for the same period this year. But for the month of October, it was the fifth selling car, trailing only Ford, Chevrolet, Plymouth, and Buick in that order.

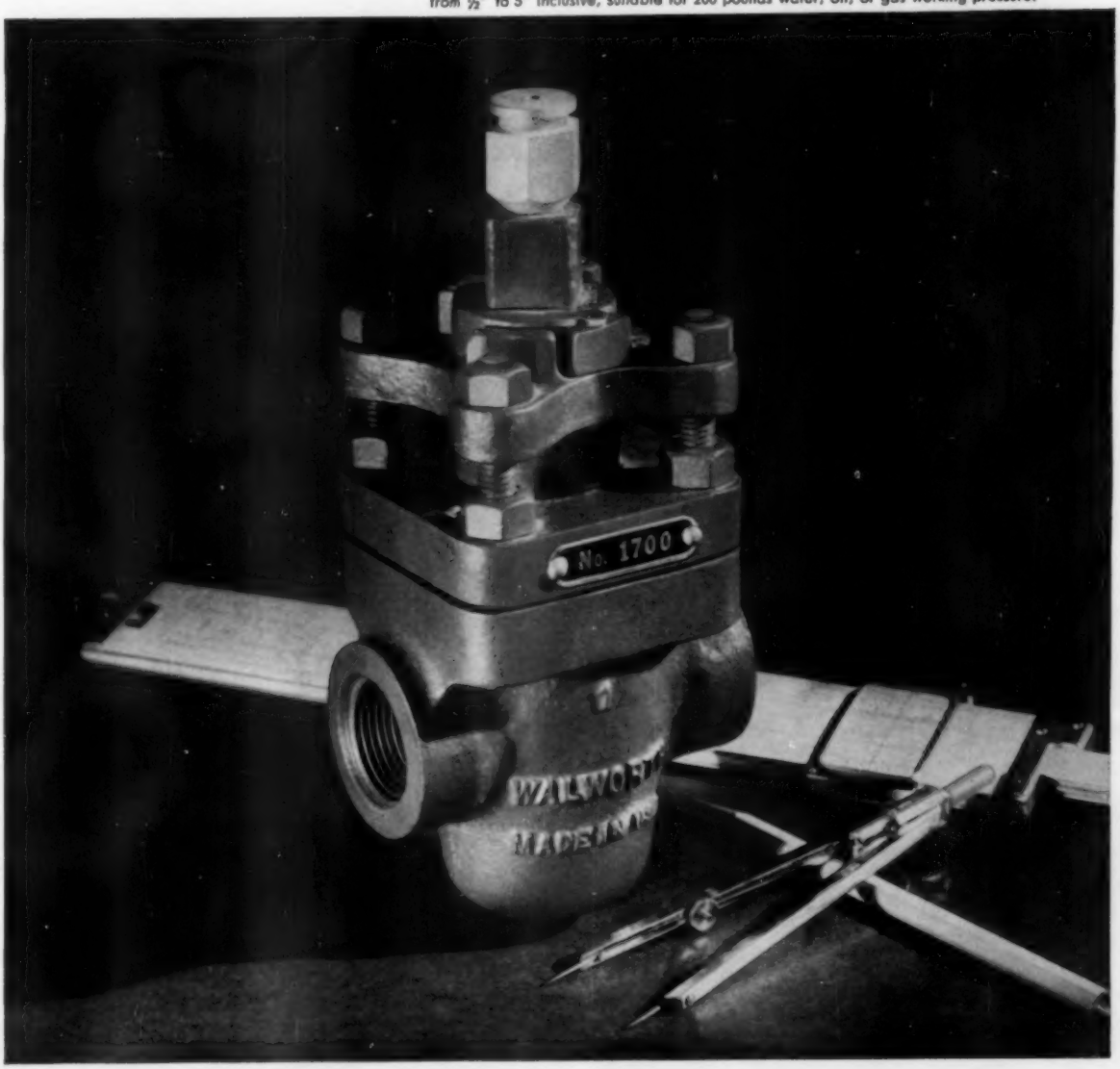
Here's one company's answer to the age-old problem of keeping service station rest rooms clean.

Lion Oil is using a fleet of new white panel trucks to carry "cleanliness engineers" into stations in its eight-state marketing area.

The engineers train operators in keeping the rest rooms clean and adequately supplied. The trucks carry supplies, accessories, and tools for minor repairs.

The Oil and Gas Journal is published weekly with an additional issue in January by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa 3, Okla. Second-class postage paid at Tulsa, Okla. United States and Foreign rates to the petroleum industry, 1 year $5, 2 years $8, 3 years $10.

Illustrated here is the Walworth Lubricated Plug Valve No. 1700, available in sizes from ½" to 5" inclusive, suitable for 200 pounds water, oil, or gas working pressure.

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# TECHNOLOGY–OPERATION

**Refining-Processing**

Gamma Rays + X-Ray Films—New Way to Detect Corrosion . . . 64

*By E. G. Pauschenwein and P. C. Trounce*

This combination enables the inspection engineer to record and plot corrosion with minute accuracy. First use was made by Canadian Oil Companies at Sarnia refinery in 1957, and since that time standardized procedures, equipment, and measuring techniques have been developed to bring this method to the status of a major inspection tool.

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*By John Manry III*

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*By W. B. Bleakley*

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*By Ben H. Caudle*

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*By E. T. Guerrero and F. M. Stewart*

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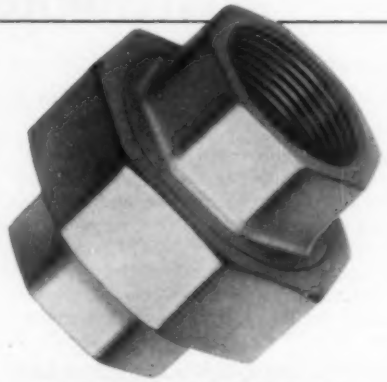

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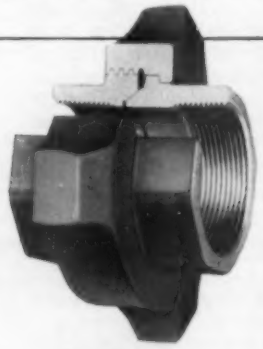

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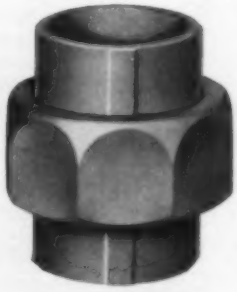

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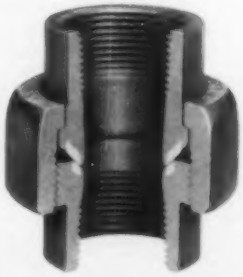

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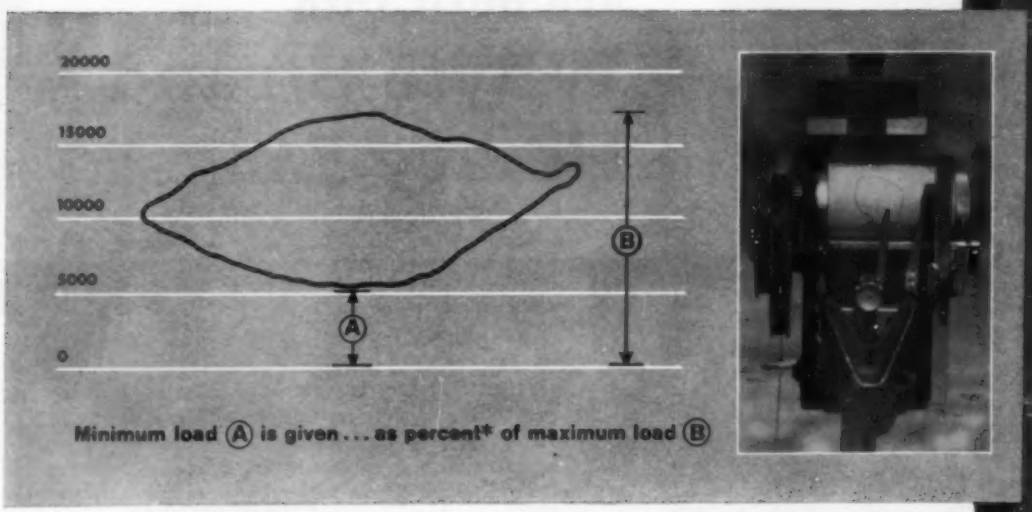

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * | 60% | 40% | 20% | 60% | 40% | 20% | 60% | 40% | 20% | 60% | 40% | 20% |
| | NON-CORROSIVE OR EFFECTIVELY INHIBITED | | | | | | | | | | | |
| N | 8,596 | 7,982 | 6,140 | 12,376 | 11,492 | 8,840 | 16,828 | 15,626 | 12,020 | 21,980 | 20,410 | 15,700 |
| Y | 12,280 | 11,052 | 10,131 | 17,680 | 15,912 | 14,586 | 24,040 | 21,636 | 19,833 | 31,400 | 28,260 | 25,905 |
| | CARBON DIOXIDE OR SWEET CORROSION | | | | | | | | | | | |
| L | 10,745 | 9,517 | 8,596 | 15,470 | 13,702 | 12,376 | 21,035 | 18,631 | 16,828 | 27,475 | 24,335 | 21,980 |
| | HYDROGEN SULPHIDE OR SOUR CORROSION | | | | | | | | | | | |
| T | 10,745 | 9,210 | 7,675 | 15,470 | 13,260 | 11,050 | 21,035 | 18,030 | 15,025 | 27,475 | 23,550 | 19,625 |

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**Monel Bubble Cups and Tray** for top of new fractionating tower completely engineered and fabricated by Fritz W. Glitsch and Sons, Inc., Dallas, Texas. Notice Monel weirs and baffles.

# Here's where Monel proves year-after-year resistance to common tower-top corrosives

Tower-top corrosion *can* be held within practical limits.

Monel* nickel-copper alloy bubble caps proved *that* long ago. Their record . . . at temperatures up to 500°F. . . shows outstanding resistance to the aqueous hydrochloric and sulphuric acids and the corrosive salts commonly present in this critical upper section.

Today, for towers handling corrosive streams, Monel alloy is preferred in this location.

The men with the sharp pencils say Monel alloy costs less per pound than other commercially available alloys able to withstand the corrosion in tower tops.

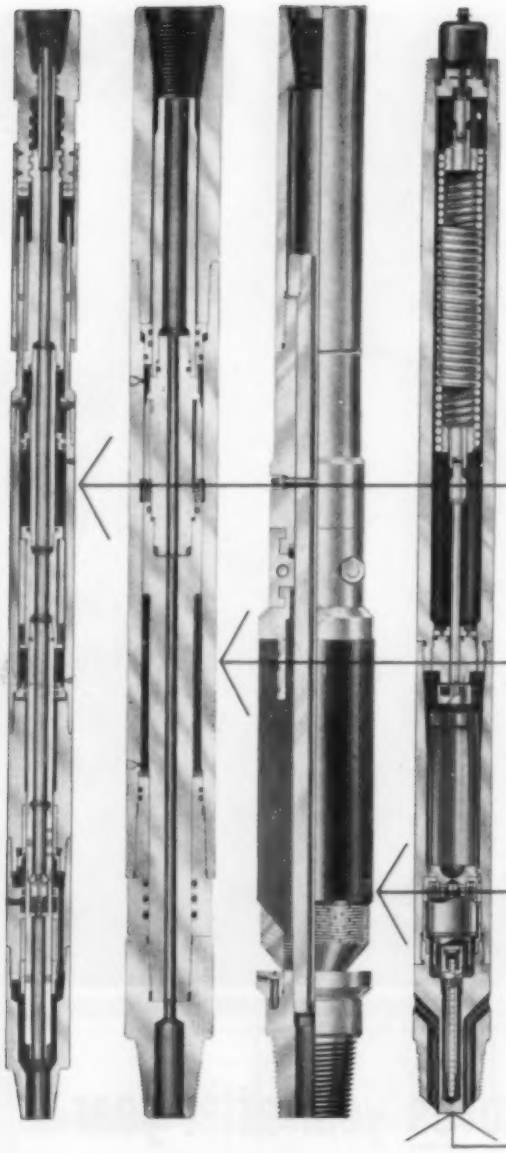
Fabricators such as Fritz W. Glitsch & Sons, Inc., find it is easy to form . . . lends itself well to lined or clad construction. Increasingly, they find it specified not only for caps and trays but also for distribution pipes, fittings, linings, the shell itself and overhead condensers.

Another advantage. Monel equipment can be field erected and easily repaired in the field. No heat treatment after welding is required to maintain corrosion resistance.

How is your tower down-time record? If it's not what it should be and corrosion is the cause, look into the possibilities of Monel alloy construction. Simply write Inco's Corrosion Engineering Section. *Registered trademark

**The International Nickel Company, Inc.**
67 Wall Street INCO New York 5, N.Y.

# INCO NICKEL ALLOYS



# *the tool the test designed*

**The Johnston** Shut-In Hydraulic Tester. **Designed for positive operation under a wide range of testing conditions. One-piece construction means quicker "make-up" and "break-down" saving valuable rig time.**

**The newest Johnston Jar, the** Type HS-1 Hydraulic Jar, **answered the needs dictated by drill stem testing operations. More jarring action from this "easy to maintain" tool. Shorter for "easier handling" and faster "make-up." Designed to consistently deliver and withstand innumerable shocking blows.**

**The Johnston** Bob-Tail Packer. **Its design features a reduction of the necessary rubber diameter while assuring a completely effective seal. The increased by-pass area improves running characteristics and speeds up running and pulling time. In washed-out or out-of-gauge holes a larger packer and packing element gives the same advantages.**

**Johnston** Type "T" Pressure Recorder. **Unfailing accuracy, sensitivity and dependability under all types of formation testing conditions. Extensive laboratory and field tests proved the Johnston Tension Type recorder to be more accurate and dependable, consistently, under all conditions.**

***Johnston's thirty years of manufacturing and testing know-how is easily recognized in The Tool The Test Designed. Each piece of Johnston equipment is designed to meet the requirements of the test under all types of well conditions.***

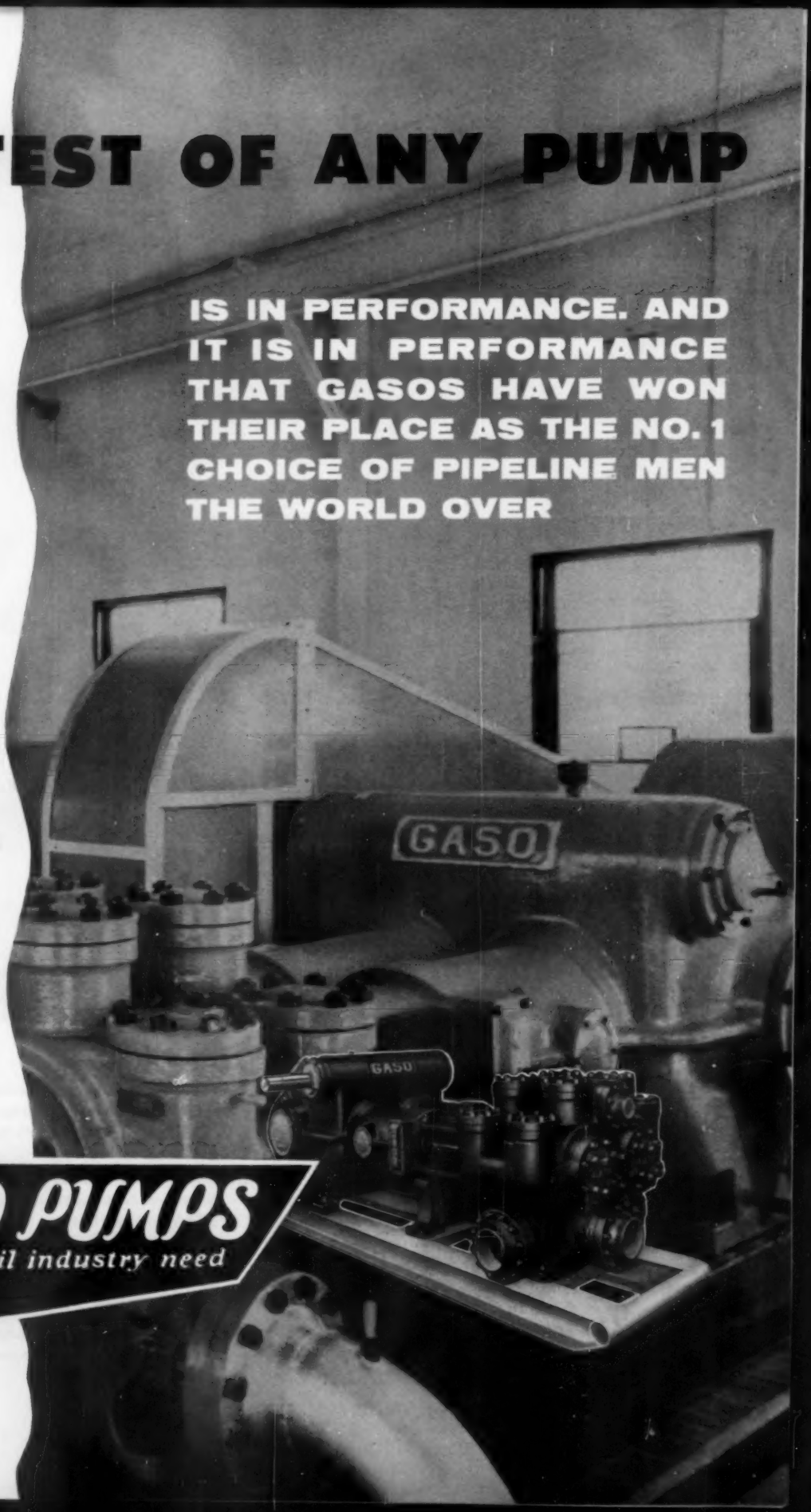
**Rely on Johnston for all your drill stem test needs always. Johnston Testers, Inc., Houston, Texas; Long Beach, California; Calgary, Alberta, Canada. Export Sales Office, Houston, Texas.**

A WORLD OF EXPERIENCE

**JOHNSTON TESTERS**

# THE TEST OF ANY PUMP

## IS IN PERFORMANCE. AND IT IS IN PERFORMANCE THAT GASOS HAVE WON THEIR PLACE AS THE NO. 1 CHOICE OF PIPELINE MEN THE WORLD OVER

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FOR FULL INFORMATION on Gaso Pumps, write for copy of our latest catalog

**GASO PUMPS**
*for every oil industry need*

GASO PUMP & BURNER MFG. CO.
TULSA, OKLAHOMA
*Export office:* 149 BROADWAY, N.Y.

## How deep for oil?

*How far down into the earth's depths can we go after this vital substance?* Today, the question remains unanswered. We are still going down!

However, continuous probing beneath the earth's surface depends on how much punishment tubular materials can stand. They must be worked hard and deep. They must resist twisting action, fatigue and collapse. And they must be ready to meet the more rigid stresses of deeper drilling tomorrow. You can bet when new records are set USS National Seamless Oil Country Tubular Products will be on the job. They are acknowledged the world over as the most ideal materials for deep well work because their strength and dependability can be attributed to two vital factors—quality steel and a unique way of manufacture. Each seamless tube is pierced from a solid billet of steel. And only steel of the very best forging properties and of the highest uniformity can be used, since the modern piercing operation tends to search out any defects in the metal.

For drill pipe, casing and tubing that can really "take it"—products that will consistently give you the most service per dollar invested—remember to specify USS National Seamless Oil Country Tubular Products . . . every time!

*USS, National and ◈ are registered trademarks*

**Some of National Tube's most notable contributions to the oil industry:**

**National Deoxidized Bessemer Steel Casing and Tubing**—Grades H-40, J-55. Especially well suited for oil production because of its combination of high yield strength and good ductility.

**National Warm-Worked Casing**—Grade N-80. An extremely high-strength casing possessing a uniformity of physical properties which gives it high collapse resistance and greatly increased joint strength. It is hydrostatically tested to 80% minimum yield strength up to a maximum of 10,000 psi.

**National Deep-Well Casing**—The strongest casing produced under API specifications to meet constantly increasing depths. Due to the severe service for which it is intended, it is hydrostatically tested to 80% minimum yield strength up to a maximum of 10,000 psi.

**National (B) Buttress Thread**—Developed to satisfy the need for a casing joint which will safely and economically support the weight of deep-well casing. The buttress-thread joint is comparable in strength to that of the body of the pipe.

For further information, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa. Export Distributors: United States Steel Export Company, New York.

*"The world's largest and most experienced manufacturer of tubular products . . ."*

USS **National Tube Division of United States Steel**

# TELETAX* TELEMETERING

## by Foxboro...

### engineered for the most advanced transmission techniques

Telemetering matched in performance with famous Foxboro instruments — that's the Foxboro Teletax Telemetering System.

Through use of impulse-duration signals, Teletax electrically transmits measurements of a remotely-located variable to the central control station. Here, the Teletax receiver records the duration of impulse, which is directly proportional to the measured variable.

The Foxboro Teletax System is noted for its simplicity, its versatility, and its high sustained accuracy. For a transmission medium, it can use either AC or DC, an audio frequency carried on a transmission line, or radio or microwave impulses. Sustained accuracy is 0.5% of full scale.

**TELETAX RECEIVERS**

Teletax receivers include: Single or Dual Receivers; Multi-Record Receivers for recording up to 6 separate measurements on one chart; and Teletax Receiver-Controllers for automatic operation. And the Teletax signal can be simply converted to digital information.

**TRANSMISSION LINK**

With Foxboro's Teletax Telemetering System, you can use the most advanced transmitting techniques: two wire lines, power lines, radio or microwave. As many as 25 different signals can be handled in each direction, simultaneously.

**TELETAX TRANSMITTER**

The Teletax Transmitter houses either one or two standard Foxboro measuring elements — plus the Teletax transmitting mechanism. It will transmit to a control center hundreds of miles away just as easily as to one nearby. It also indicates or records locally if desired.

The Teletax Transmitter needs no periodic maintenance whatever, while the receiver requires only occasional oiling. And the receiver has a minimum of mechanical components to wear — no clutch to slip or jam.

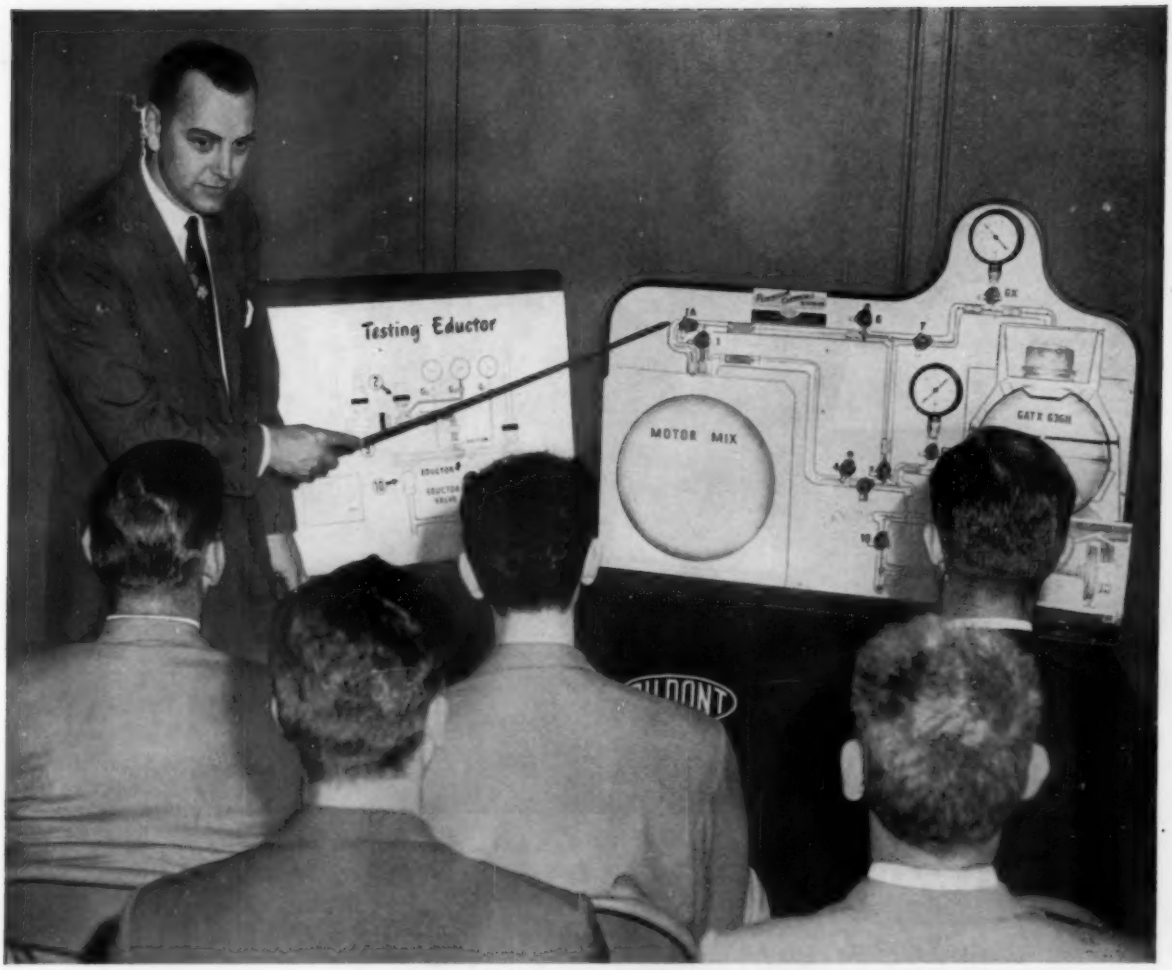
Foxboro Teletax Systems are now in wide use on natural gas systems, water works, oil fields, power plants, steel mills, etc. Write for Bulletin 17-11C — it gives all the details. **The Foxboro Company, 6012 Neponset Avenue, Foxboro, Mass.**

*Reg. U. S. Pat. Off.

FOXBORO

REG. U.S. PAT. OFF.

**TELETAX TELEMETERING**




TYPICAL TRAINING SESSION conducted by Ron W. Beecher, Du Pont's Central Region Operations Coordinator, using scale-model blending plant to show safety procedures in unloading and weighing TEL from tank car.

# Du Pont offers on-the-job training program for economical handling of tetraethyl lead

Du Pont helps refiners train new personnel in handling tetraethyl lead safely, economically and efficiently. The course proves of value also as a refresher for experienced personnel. Du Pont takes the "classroom" right to the refinery and teaches the fine points, as well as the fundamentals, of tetraethyl lead blending.

### Dramatic Visual Aids

A scale-model blending plant, turnover charts, and cutaway valves, eductor and flex hose are among the training tools used. They graphically show employees the why as well as the how of following prescribed procedures.

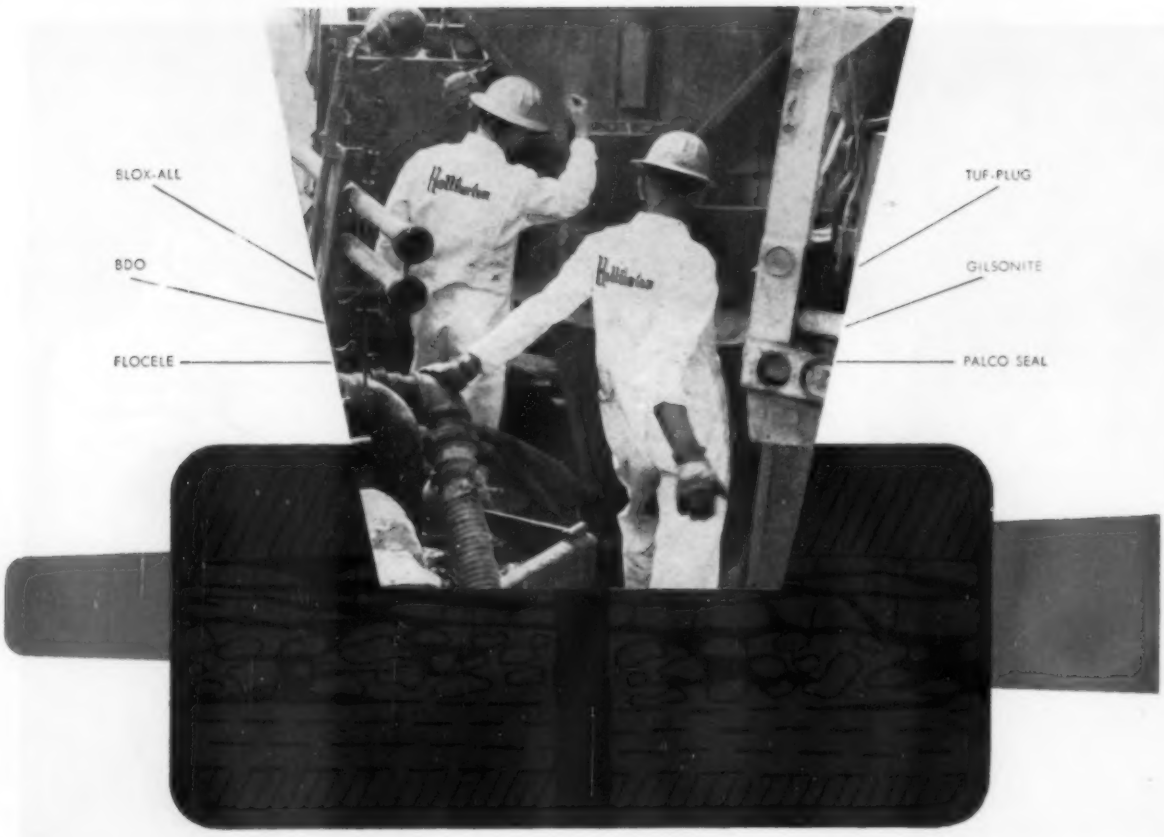
The course is presented in two parts: the theory, or classroom, sessions—in which are presented the reasons behind various techniques. Here visual aids are used. Then come the practice, or on-the-job, sessions. During these, personnel go through the actual step-by-step unloading and blending of TEL, with running commentary by the Du Pont instructor.

If you are interested in this service, get in touch with your Du Pont representative. He can make all arrangements for presenting a training program at your plant.

E. I. du Pont de Nemours & Co. (Inc.), Petroleum Chemicals Division, Wilmington 98, Delaware.

DU PONT
Better Things for Better Living
. . . through Chemistry

Tetraethyl Lead
and other
Petroleum Additives




# *The RIGHT REMEDY for every type of*
# LOST CIRCULATION EMERGENCY

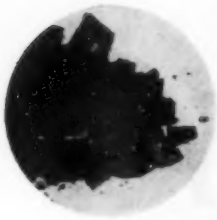
When drilling through highly permeable formations, cavities, fissures or vugs, lost circulation is a common difficulty. If lost circulation is not remedied, it may jeopardize the success of the drilling operation. In any case, serious loss of rig time and greatly increased cost can result.

Each geographic region . . . each type of thieving zone . . . each well condition presents different remedial problems.

By plugging, blocking, squeezing and other techniques . . . in combination with the proper tools and the right materials . . . Halliburton specialists help regain lost circulation in each individual emergency case.

At the first sign of lost circulation . . . consult Halliburton immediately. Your nearby Halliburton Representative will help save "profit-life" by rushing the proper remedies to the site.

**HALLIBURTON**
OIL WELL CEMENTING COMPANY
DUNCAN, OKLAHOMA



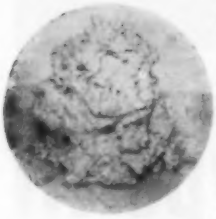
BLOX-ALL...

a chemical solution for treating difficult lost circulation problems during drilling. Blox-All solution thickens in drill pipe into a soft gel stage, is then extruded into lost circulation zone. Mixed at the site and pumped as a liquid into the well through the drill pipe, it sets to form a stiff, rubbery mass.

TUF-PLUG...

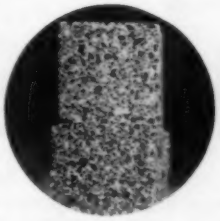
a high strength granular bridging agent for cement slurries which seals wide fractures more effectively than most fibrous materials. Tuf-Plug is effective alone or as good companion material used in conjunction with other flake or fibrous lost circulation materials, sealing extremely stubborn zones. The high mechanical strength of Tuf-Plug will support high columns of heavy cement slurries.

## HALLIBURTON PRODUCTS AND MATERIALS
## first aid for lost cirulation problems



BDO
(BENTONITE-DIESEL OIL.. "GUNK SQUEEZE")...

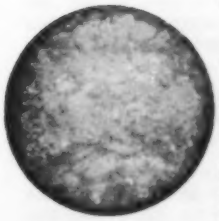
penetrates lost circulation area as putty-like material. BDO is a thin slurry of Bentonite and Diesel Oil: Bentonite combines with water to swell and form a high-strength gel, Diesel Oil acts as carrier. BDO slurry is mixed with standard cementing equipment and hopper. Pumped down drill pipe at same time drilling mud is pumped down annulus. Slurry mixes and thickens by hydration with drilling mud to a putty-like material ... entering zone of lost circulation for desired shut-off.



GILSONITE...

a new granular light weight additive useable with any type of cementing composition for the reduction of slurry density and has superior lost circulation control characteristics. Is resistant to corrosion of waters or brines, resists attacks of acids or alkalies, has a high insulating value against electric currents.

...adds volume *not* weight to cement slurry (specific gravity of 1.07), resulting in light weight slurries having high compressive strength at low temperatures. Has been used successfully for high fill-up cementing, multiple stage cementing, plug back operations and setting production liners in gas wells with weak formations.



HALLIBURTON FLOCELE...

when added to cement slurries, effectively bridges and seals most fissures and other thief zones. It prevents or lessens loss into permeable formations during casing cementing. Flocele is chemically inert cellulose film flake which does not affect the pumping or setting properties of cements. Economical; usually 1% or less of Flocele is sufficient.

PALCO SEAL...

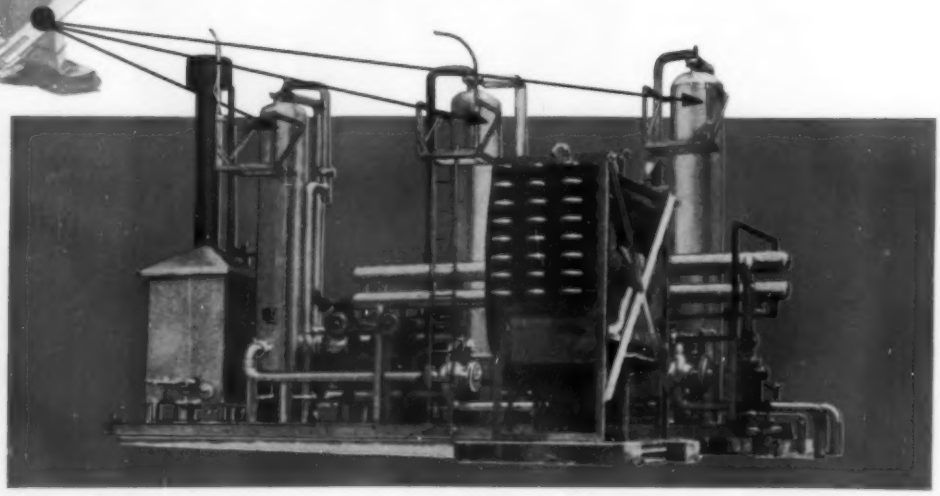
composed of redwood bark fibers, offers several advantages as drilling mud additive in lost circulation problems: Economical, both in price and volume... Free from decay... Free from added chemicals which affect viscosity of drilling mud... Uniform in sack size, easy to stack or handle.

# CEMENTING SERVICES

284 SERVICE CENTERS—JUST MINUTES AWAY FROM YOUR WELL

# Get twice the Hydrocarbon recovery

at LESS cost



with a new

# Parkersburg DAU type III

The Parkersburg Rig & Reel Company, who originated and still leads in unitized short cycle dehydration-hydrocarbon adsorption units, now announces another remarkable advancement in unit design and application . . . an application that can DOUBLE your distillate recovery over a two tower unit of the same size. The new Parkersburg DAU Type III uses three desiccant towers instead of two as previously used. Actual field tests tell the story.

A 24" Parkersburg DAU Type II (two-tower unit) on a gas stream near Yoakum, in South Texas, was converted to a DAU Type III (three-tower unit). *Distillate recovery jumped from 11 barrels per day to 22 barrels per day,* or DOUBLE the amount recovered through the two-tower unit.

And you save three big ways with a new Parkersburg DAU Type III:

1. **Less initial cost** — The DAU Type III will recover as much or more distillate than any other type of the next larger size. This means lower cost of equipment, lower installation costs.
2. **Less replacement cost** — Smaller towers are used with a DAU Type III. There is less desiccant to be replaced during maintenance.
3. **Less operating cost per barrel of recovery** — The DAU Type III operates on shorter cycles by preheating regeneration gas with retained heat in tower on cooling cycle. Less fuel is required to operate.

*Your Parkersburg representative can tell you about the new Parkersburg DAU Type III. See him TODAY!*

THE PARKERSBURG RIG AND REEL CO.

**THE PARKERSBURG RIG & REEL COMPANY**

*Division of Parkersburg — Aetna Corp.*

PRODUCTION EQUIPMENT DIVISION OFFICES: P. O. BOX 13295, HOUSTON 19, TEXAS

# I'M GLAD THIS RIG HAS WECO IRON!

Good "Iron" can make the difference between profit and loss on a drilling contract. Crewmen like to work with equipment that is safe and able to "take it" without special handling. Operators and owners are happy to add up the savings in time and money that come from using quality "iron."

WECO Unions are good "iron." Full-circle metal-to-metal contact sealing of WECO's ball and cone seats holds the highest pressures under all conditions of surge and vibration. Tough, strong nuts and subs forged or cast from high grade steel give long service, even under the hard usage of today's competitive drilling programs. WECO Unions available in sizes 1" through 12", in pressures from 1,000 through 15,000 psi.

*Sold by Supply Stores Everywhere.*

U-4-58

WECO®

**WELL EQUIPMENT MFG. CORP.**
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

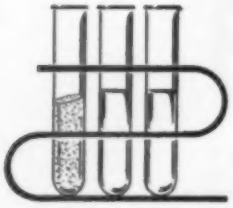
fmc

# Making your own oil and gasoline additives ?

**Monsanto Phosphorus Inorganic Intermediates give you big benefits in additive performance**

## FOR OIL ADDITIVES:

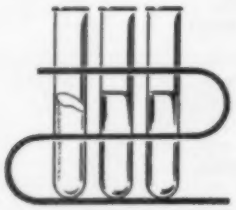
**PHOSPHORUS PENTASULFIDE AND OTHER PHOSPHORUS INORGANIC INTERMEDIATES** *are converted to derivatives which...*



1. Serve to inhibit corrosion and oxidation
2. Help prevent formation of varnish, lacquer and sludge on internal combustion engines
3. Impart a detergent action that retards ring sticking

## FOR GASOLINE ADDITIVES:

**PHOSPHORUS TRICHLORIDE, PHOSPHORUS OXYCHLORIDE AND PHOSPHORUS PENTOXIDE** *are used in compounds which...*



1. Help reduce deposits on combustion chamber walls
2. Make combustion chamber deposits less conductive—less likely to hold heat and glow
3. Help prevent fuel pre-ignition, improve spark plug performance

**MONSANTO** Phosphorus Inorganic Intermediates are also used in grease additives, quenching-oil additives, motor-oil reclaiming compounds, machining lubricants and surface coatings for machine parts.

**FOR RAW MATERIALS** for production of additives, contact Monsanto to get what you want in quantity, quality and delivery.

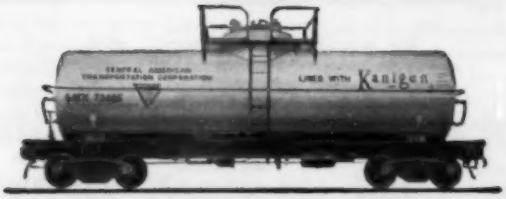
For further information, call or write Monsanto —your *big benefits* source of phosphorus inorganic intermediates—for technical bulletin I-35, "Phos. Trichloride and Phos. Oxychloride," and/or technical bulletin I-159 "Phos. Pentasulfide."

MONSANTO CHEMICAL COMPANY
Inorganic Chemicals Division
St. Louis 24, Missouri

Monsanto

**ORDER FROM "THE WORLD'S LARGEST PRODUCER OF ELEMENTAL PHOSPHORUS"**

# THE TANK CAR NEWS OF 1958




## *GATX cars lined with Kanigen®... new nickel-alloy coating*

KANIGEN, a unique patented process, deposits a hard, uniform, corrosion-resistant nickel-alloy coating on tank car interiors . . . lasts four to six times as long as phenolic, epoxy or neoprene linings. You can load at high temperatures that would destroy other linings. For example, 73% caustic soda can be piped in at unlimited temperatures.

Tank cars lined with KANIGEN are also being successfully used for liquids such as tetraethyl lead, ethylene oxide and glucose.

If your product is a liquid, GATX furnishes or can build a tank car to transport it. GATX maintains a nation-wide network of shops for servicing.

No capital investment . . . when you ship GATX.

*KANIGEN is a trademark which identifies chemical nickel coating by GENERAL AMERICAN TRANSPORTATION CORPORATION and its licensees, the product resulting therefrom and compositions produced by them for use in chemical nickel coatings.*

GATX GENERAL AMERICAN TRADE MARK

**GENERAL AMERICAN TRANSPORTATION CORPORATION**

*135 South LaSalle Street • Chicago 90, Illinois*

*Offices in all principal cities*

# They Say—

## Haifa refinery a big one

Dear Sir:

In your December 1 issue on page 95, "Haifa Refinery Sold," you have an error—is it not?

The capacity of the Haifa refinery is not 87,000 bbl. per day—this seems awfully big. I read somewhere that it was only 13,000 bbl. per day.

E. J. Barth
Edwin J. Barth
& Associates
Consultants, Chemical
Engineers
New York.

*(Editor's note: Capacity does exceed 80,000 bbl. Runs have been limited since pipeline flow from the Persian Gulf was halted in 1948.)*

## Wash day at the drill site

Dear Sir:

Concerning your article, "Wash day at the drill site," in the November 10 issue (p. 92), the character in the picture chose to do his laundry at the well because that was his base of operations.

He had rigged up a washing machine which he attached to the walking beam and using the hot water and steam from the boiler, with no effort on his part, came up with the whitest, brightest, cleanest wash this side of Cheer.

My father, Randolph Rogers, as a young man operated a lease owned by Capt. J. T. Jones at Bordell (near Bradford) in the early days of oil development in that vicinity and he used just such a contraption to do his laundry.

I am looking forward to your Petroleum Panorama issue. I know it will be great.

R. N. Rogers
Broken Arrow, Okla.

## Longest pipeline crossing

Dear Sir:

This is written to call to your attention the article on page 215 of your November 17 issue entitled "How Westcoast Crossed the Rivers."

In the box at the beginning of the article which has the heading "About the Crossings," I wish to call your particular attention to the last sentence which I quote, "The Peace River crossing (1,675 ft.) has the longest clear span of its type in the British Commonwealth and is exceeded in length by only one other pipeline crossing in the world."

This same statement has appeared in other trade magazines within recent months and since it is flagrantly incorrect I feel it is time for a correction to be made.

In refuting this persistent claim, the facts are as follows: We have three bridges having main spans in excess of 1,675 ft. as follows: South Canadian River, near Norman, Okla., Oklahoma Natural Gas Co., includes a main span of 1,760 ft.; Atchafalaya River, near Melville, La., Transcontinental Gas Pipe Line Co., main span of 2,000 ft.; Mississippi River, near Grandtower, Ill., Texas Illinois Natural Gas Pipeline Co., main span, 2,150 ft.

Wilder Kenan
Matthews & Kenan
Consulting Engineers
San Antonio, Tex.

## Welding method shown

Dear Sir:

We note in your Newsletter dated October 6 an item regarding a German process for automatic field welding.

We would greatly appreciate it if you could advise us who manufactures this machine and when and where it is to be demonstrated in Houston.

D. T. O'Connor
New York.

*(Editor's note: Electromagnetic arc welding was demonstrated in late October at the Houston yard of Crutcher-Rolfs-Cummings, Inc.)*

## Management's political role

"The new Congress will be further to the left than the last and more hostile to business in general and to the petroleum industry in particular. Our industry will, no doubt, continue to be a favorite whipping boy.

"Our companies face political problems, and if industry is to defend itself effectively, it must move into the political arena in order to really come to grips with its adversaries on these issues. This is a clear-cut responsibility of management, and the necessity is greater than it has ever been before.

"Every company of any size can and should have a program for meeting these problems which directly affect its business interests. This must be a sustained program, because these problems continue to arise one after another. These are problems in practical politics, in which management must clearly put forth partisan efforts —not partisan in terms of political parties—but partisan on the basis of what is good for the company."

*Harold S. Skinner, associate general counsel, Continental Oil Co., in a speech to the Texas Oil Information Committee, San Antonio.*

## Congressman looks at taxes

"Some of the most difficult decisions that we as tax legislators face involve requests for special tax benefits, or incentives, for some obviously worthwhile objectives.

"But the world is full of worthwhile objectives and if we were to give special tax benefits for even a small proportion of these new requests, our tax structure would surely be riddled with unfairness.

"A review of some features of this type, already in the existing tax system, represents one of the more important aspects of any reassessment of the present tax structure.

"Unless we hold to a minimum the special tax benefits and privileges accorded various types of taxpayers, we cannot hope for simplicity in our tax laws.

"A great deal of revenue could be provided by broadening of the tax base, a removal of some special deductions and preferences, and an increase in rates on some specially favored income."

*Rep. Wilbur Mills, chairman of the House ways and means committee, in speeches to the National Association of Mutual Savings Banks and to the Tax Foundation, New York.*

## The reluctant politician

"Businessmen are traditionally reluctant to step into the political stage, but it is on that stage that the story of industry's future will be played."

*T. B. Kimball, president, Sinclair Refining Co., in a speech to the Greater Atlanta Kiwanis Club.*

**Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.**

Before delivery to the oil fields every piece of Spang high strength casing and tubing from National Supply must pass this rigid Magnaglo Inspection.

# Spang high strength casing and tubing get full-length Magnaglo Inspection!

THE NATIONAL NSCO SUPPLY COMPANY

You can't compromise on quality—especially if the product is an investment like casing and tubing for a deep well. So ordinary visual inspection isn't good enough for these Spang tubular products. We look *full-length* for surface defects on one of the largest and most efficient "black light" inspection units ever installed in any pipe mill.

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The full-length Magnaglo Inspection of Spang high strength tubular goods is further proof that you get the best—in design, manufacturing care and performance—when you buy from National Supply.

The streamlined interior and exterior contours of Spang Extreme Line Casing insure maximum round-the-clock running efficiency. The rugged integral joint is 100% leak-resistant.

# Spang Extreme Line Casing runs in faster, has 100% leakage resistance!

Drilling crews like to work with SPANG Extreme Line Casing because it's easy to handle. When they're running-in, only 5 to 7 turns with the spinning line and less than one turn with the tongs are necessary. It's very easy to stab, *cannot* be cross-threaded, and its positive shoulder contact engagement prevents overtonging. But there are more good reasons.

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Precision-manufactured SPANG Extreme Line Casing pays off *in* the well, too. It has the mechanical and metallurgical properties to withstand high tensile loading, and to resist the severe pressures found in present-day deep drilling. Its rugged integral joint is 100% leak-resistant—a highly important factor in deep, high-pressure wells. Another outstanding fact is that SPANG Extreme Line Casing can be salvaged and re-run repeatedly.

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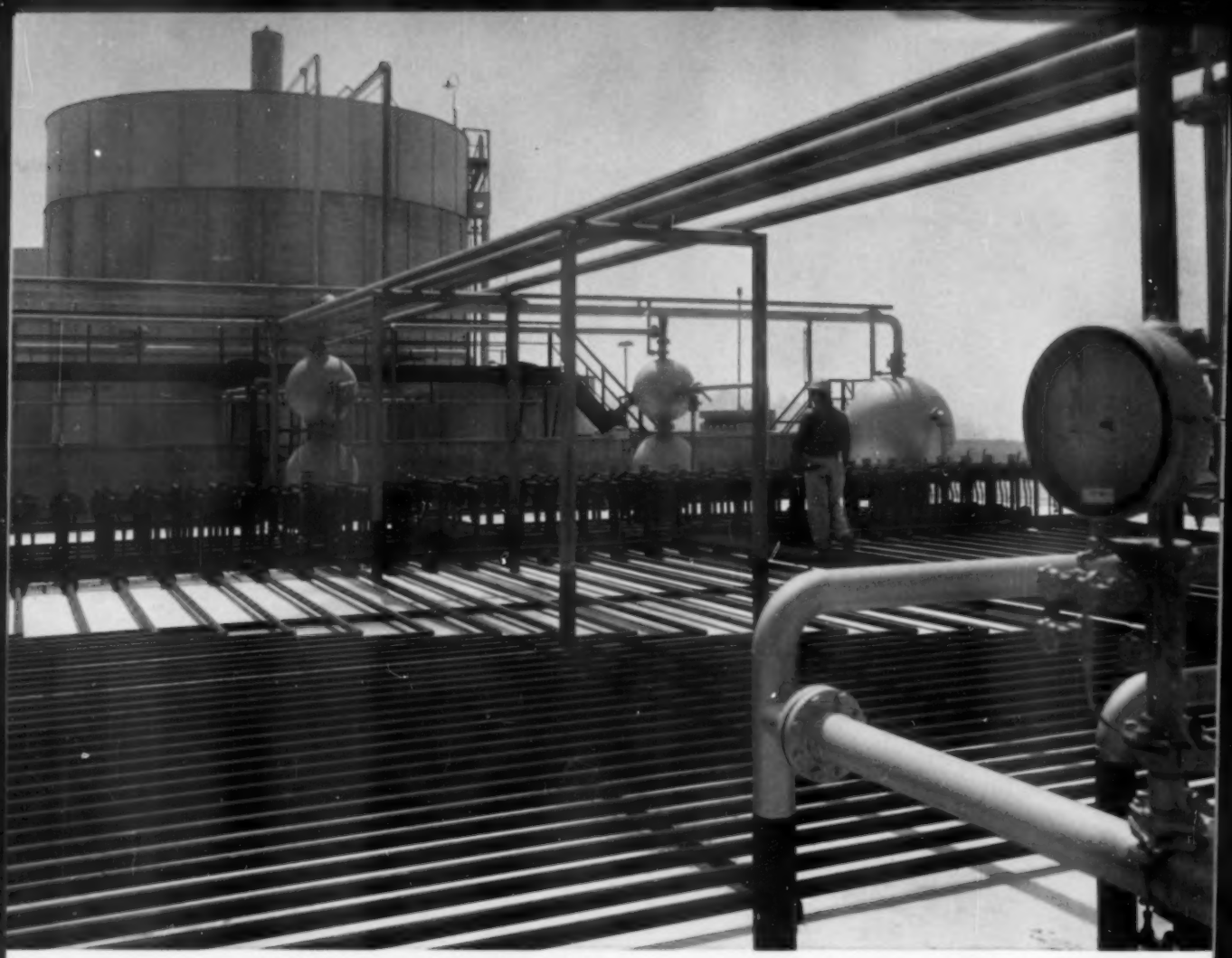
***Another outstanding Spang product on the next page!***



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# CALENDAR

**JANUARY**

**12-14** Pipe Line Contractors Association, eleventh annual convention, Americana Hotel, Miami Beach, Fla.

**12-16** Society of Automotive Engineers, annual meeting and engineering display, Sheraton-Cadillac and Statler hotels, Detroit.

**16-17** Association of Oilwell Servicing Contractors, annual meeting, Baker Hotel, Dallas.

**21-22** Western Petroleum Refiners Association, Gulf Coast regional technical-industrial relations meeting, Ben Milam Hotel, Houston.

**22-23** National Association of Corrosion Engineers, Houston section, annual short course, University of Houston campus, Houston.

**22-23** American Chemical Society, Southeastern Texas section, third biennial symposium on hydrocarbon chemistry, Shamrock Hilton Hotel, Houston.

**22-24** Texas Society of Professional Engineers, annual convention, Shamrock Hilton Hotel, Houston.

**23** Natural Gasoline Association of America, Oklahoma regional meeting, Biltmore Hotel, Oklahoma City.

**26-29** Tenth annual plant maintenance and engineering conference, sponsored by Clapp & Poliak, Inc., Public Auditorium, Cleveland.

**28-29** Annual Midwest Welding conference, sponsored by Armour Research Foundation of Illinois Institute of Technology, and American Welding Society, Chicago section, Illinois Institute of Technology, Chicago.

**30-31** Oklahoma Society of Professional Engineers, annual meeting, Mayo Hotel, Tulsa.

**FEBRUARY**

**1-4** American Association of Petroleum Geologists, Rocky Mountain section, ninth annual meeting, Civic Auditorium, Albuquerque, N. M.

**1-6** American Society for Testing Materials, D-2 committee on petroleum products and lubricants, Sheraton-Jefferson Hotel, St. Louis.

**2-22** Southwestern Legal Foundation, short course on oil and gas law, Southwestern Legal Center, Dallas.

**11-13** Southwestern Legal Foundation, tenth annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.

**11-13** National Association of Corrosion Engineers, Tulsa section, tenth annual pipeline corrosion short course, Mayo Hotel, Tulsa.

**16-18** American Management Association, seminar on management problems of exploration and production, Hotel Astor, New York.

**15-19** American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Sir Francis Drake Hotel, San Francisco.

**24-25** University of Oklahoma, sixth geological symposium, Norman, Okla.

**27** Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

**26-28** Pipe Line Contractors Association of Canada, fifth annual convention, Castle Harbour Hotel, Bermuda.

**MARCH**

**3** Petroleum Equipment Suppliers Association, Pacific district, annual membership meeting, Ambassador Hotel, Los Angeles.

**9-11** Midwest Gas Association, annual meeting, Hotel Fort Des Moines, Des Moines.

**11** Petroleum Equipment Suppliers Association, southwestern district, annual membership meeting, Shamrock Hilton Hotel, Houston.

**13** American Institute of Chemical Engineers, Sabine area section; American Chemical Society, Texas-Louisiana Gulf section; sixth annual joint technical meeting, Lamar State College of Technology, Beaumont, Tex.

**16-18** Western Petroleum Refiners Association, forty-seventh annual meeting, Hilton Hotel, San Antonio, Tex.

**16-18** Society of Automotive Engineers, national passenger car, body, and materials meeting, Sheraton-Cadillac Hotel, Detroit.

**17-18** Manufacturing Chemists' Association, air and water-pollution abatement conference, Netherlands Hilton Hotel, Cincinnati.

**18** Petroleum Equipment Suppliers Association, eastern district, annual membership meeting, Duquesne Club, Pittsburgh.

**16-19** American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, forty-fourth annual meeting, Memorial Auditorium, Dallas.

**19-20** New England Gas Association, annual meeting, Hotel Statler, Boston.

**25-27** American Petroleum Institute, Division of Production, southern district meeting, Roosevelt Hotel, New Orleans.

**APRIL**

**2-3** Society of Petroleum Engineers of AIME, Rocky Mountain petroleum section, Casper, Wyo.

**2-3** American Institute of Mining, Metallurgical, and Petroleum Engineers, technical conference on stress corrosion, Mellon Institute, Pittsburgh.

**6-7** Instrument Society of America, second national symposium on chemical and petroleum instrumentation, St. Louis.

**5-10** American Society of Mechanical Engineers, nuclear congress, Cleveland Auditorium, Cleveland.

**8-10** American Petroleum Institute, Division of Production, eastern district meeting, Penn-Sheraton Hotel, Pittsburgh.

**14** Independent Oil Men's Association of New England, annual meeting, Hotel Statler, Boston.

**14-16** Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.

**15-17** National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

**15-17** American Petroleum Institute, Division of Transportation, annual tanker conference, Jung Hotel, New Orleans.

**16-17** Rocky Mountain Oil and Gas Association, midyear meeting, Casper, Wyo.

**19-23** American Society of Mechanical Engineers, oil and gas power conference and exhibit, Shamrock-Hilton Hotel, Houston.

**22-24** American Petroleum Institute, Division of Production, Mid-Continent district meeting, Herring Hotel, Amarillo, Tex.

**22-24** Natural Gasoline Association of America, thirty-eighth annual convention, Baker and Adolphus Hotels, Dallas.

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TULSA, OKLAHOMA

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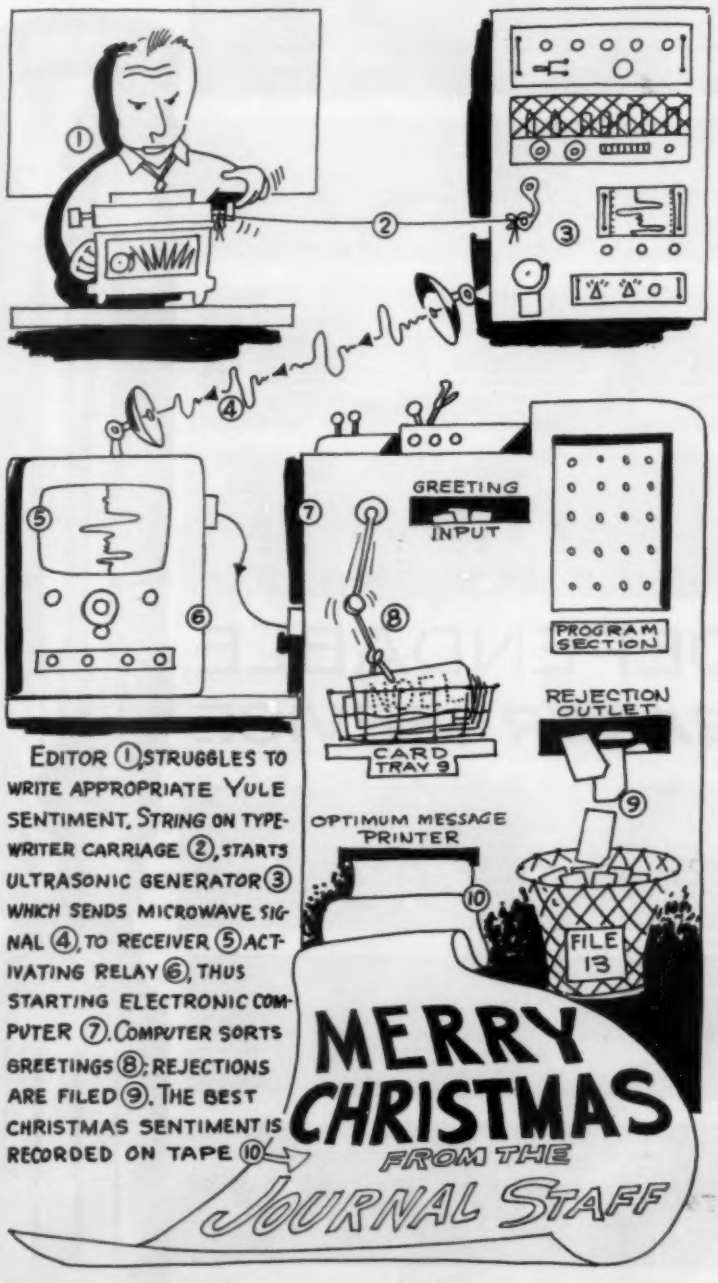
## Automated Sentiment




EDITOR ① STRUGGLES TO WRITE APPROPRIATE YULE SENTIMENT. STRING ON TYPEWRITER CARRIAGE ②, STARTS ULTRASONIC GENERATOR ③ WHICH SENDS MICROWAVE SIGNAL ④ TO RECEIVER ⑤ ACTIVATING RELAY ⑥, THUS STARTING ELECTRONIC COMPUTER ⑦. COMPUTER SORTS GREETINGS ⑧; REJECTIONS ARE FILED ⑨. THE BEST CHRISTMAS SENTIMENT IS RECORDED ON TAPE ⑩

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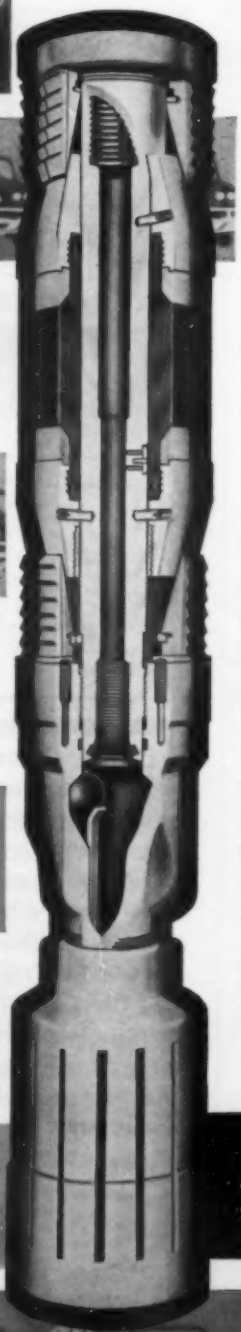

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# An oil tariff is better than regimenting the industry

BOUQUETS instead of brickbats should be tossed at the President's cabinet committee for its delay in announcing a plan for control of oil imports.

Drafting a satisfactory plan to comply with the congressional mandate in the defense amendment to the Reciprocal Trade Act is a thorny problem. It's a good thing the committee has been giving it deep thought.

The committee's aim was a voluntary plan, but with enough teeth to induce compliance. It needed to be so specific that there would be no big loopholes, and sufficiently equitable that importers would conclude that they might fare worse under a different plan.

For weeks the committee wrestled with formulas and definitions. But when it had all loopholes plugged and all contingencies covered, it found that what it had was in fact a mandatory program and one that imposed detailed regimentation on the industry.

It had created a Frankenstein monster—a degree of federal control repugnant to the basic tenets of the administration. So it backed away in horror, and has been looking for a new approach. For this it deserves high praise.

THE SOLUTION must be a choice among evils. It is most unfortunate that the recalcitrance of a small number of importers has so far kept a simple voluntary plan from operating.

It is equally unfortunate that the cabinet committee has not yet been able to devise a specific and equitable formula that would win voluntary compliance without resort to regimentation.

Perhaps it is not too late to try again. If importers realize that the alternative is a federal straightjacket, they might now agree to abide by the Government's suggested imports schedules and stop looking for loopholes to evade the intent of the program.

But if all else fails, it may be necessary to resort to some form of a tariff.

A TARIFF is the historic and ostensibly the simple way to control imports. It involves no federal regulation other than the prevention of smuggling. But there are complications in applying it to oil, which is why it has received little consideration in official quarters.

A tariff would conflict with our general policy of reducing trade barriers, stimulating foreign commerce, and aiding exporting nations. The State Department would have a difficult job of explaining that the defense amendment requires this exception to our reciprocal trade policy.

A straight tariff would penalize high-cost exporters and favor low-cost producers. And it so happens that production costs are higher in the Western Hemisphere than in the Eastern Hemisphere. Thus the effect would be the direct opposite of the defense objective, which is to lessen our reliance on the most vulnerable sources in time of war.

A tariff combined with quotas could be a way out. Crude and products within the quota would enter at present duties, while all above it would pay a new high rate. Thus penalties for noncompliance would be applied very simply at the customhouse. And even if some low-cost imports come in above quota and pay the higher duty there would still be a share of the market reserved for other exporting nations.

But there remains the problem of assigning quotas. If they are given to individual importers, our Government would still have to act as a Solomon and might end up with the regimentation it is trying to avoid. If they are assigned to exporting countries on a first-come-first-served basis, the lion's share would be grabbed by whatever importer docked the most tankers during the first few days of a quota period. Possibly the exporting nations themselves could be asked to divide up their quotas among individual companies.

ALL THESE IDEAS and problems are doubtless being explored by the committee and weighed against the conflicting interests and predilections of various segments of the industry and various departments of the Government.

Whatever the decision, it will discomfit a great many people. It will involve some rather drastic changes in commercial practices and official policies.

But one policy overrides all other considerations. That is our fundamental policy that the federal Government shall not hog-tie business by totalitarian bureaucracy. A tariff or any other plan the committee may propose should be accepted if its only alternative is regimentation.

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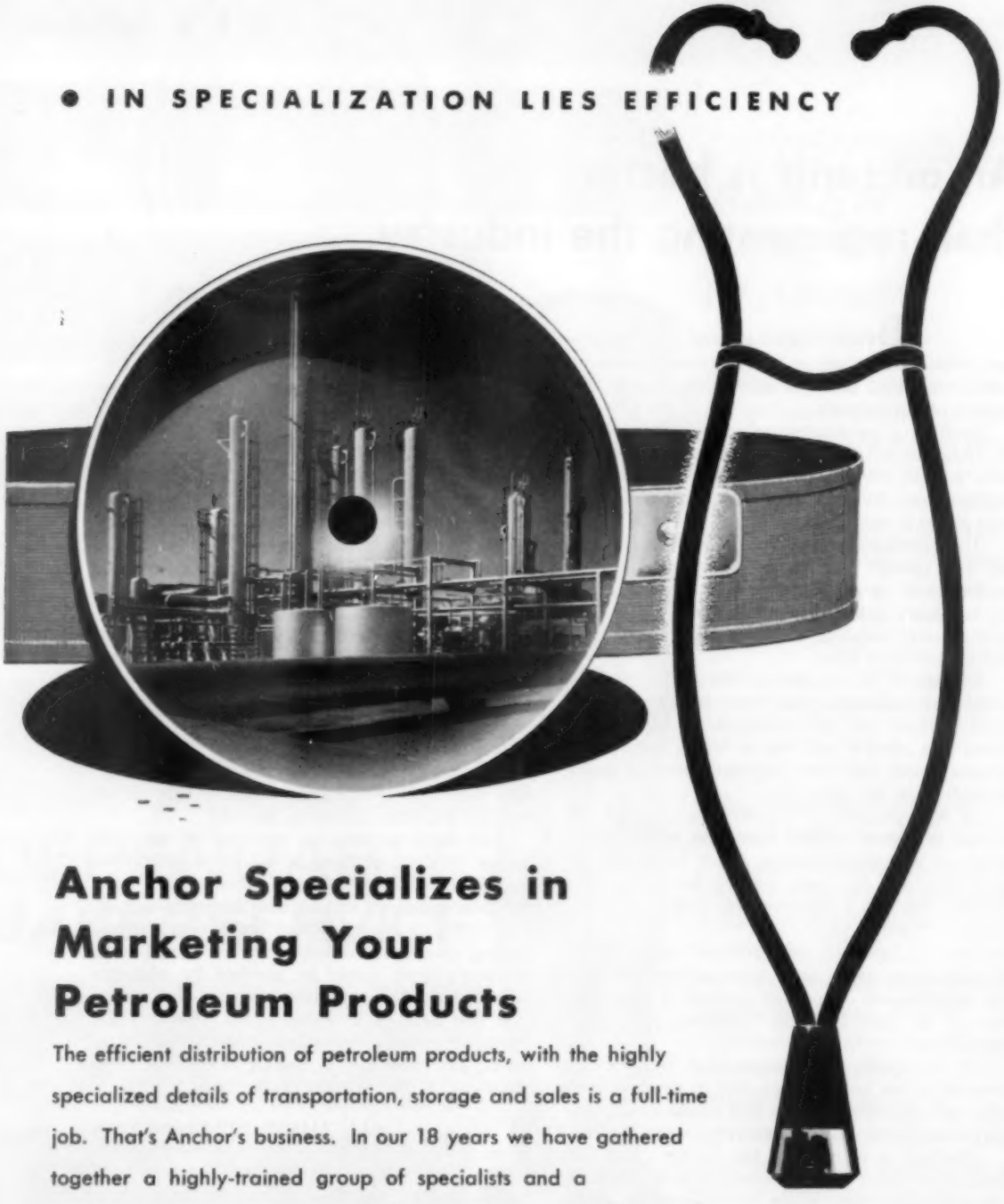

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# Oil Starting '59 With Bright Outlook

- There's a general feeling that business and industry will make sharp gains in the first half which will carry throughout the year.
- Oil will get a good share of this pickup. Total domestic demand for petroleum could jump as much as 6% with gasoline demand up over 4%.
- This is the consensus of the nation's leading oil economists, picked up in a 2-week nationwide tour by Journal Economist John Casper. It means a solid pickup after a poor year for oil.

John C. Casper

ECONOMISTS throughout the oil industry are forecasting a brighter picture for 1959.

They see a brisk pickup in industrial and general business activity in the first half which will continue through the year. They are sure petroleum will share in the gains.

Here's the composite picture they are giving oil management:

. . . **Gross national product** will fall within the range of $457 billion to $467 billion. This compares with an estimated GNP of $436 billion for 1958.

. . . **Federal Reserve Board** index of industrial activity will range from 141 to 152. The index is expected to close out this year at 134.

. . . **Total domestic demand for** petroleum should register gains ranging from 3.8 to 6%.

. . . **Gasoline demand** should show increases ranging from 3.5 to 4.2%.

The predictions were obtained in interviews with oil economists. The ranges shown represent the conservative outlook on the low side and the more optimistic viewpoint on the high side.

The consensus is that GNP will average about $465 billion, the FRB index will go up to 146, gasoline demand and total domestic demand both will show gains of at least 4%.

The economists also predict these gains will extend to exploration, drilling, and sales of equipment, services, and supplies.

Talks with the economists also revealed two very interesting developments concerning oil forecasting:

. . . **Growing dependence of oil** on health of the general economy.

. . . **Increased concern** over long-range implications of natural-gas sales for oil producers.

**Forecasting trends . . .** Economists all are taking closer looks at general business conditions before making their specific observations on the oil industry.

This explains the attention to the outlook for gross national product and the Federal Reserve Board's index of industrial activity.

Some oil economists until a few years ago believed general business conditions had only a minor effect on the oil industry. Past experiences had borne this out.

But the recent recession exploded this theory. Conditions have changed to such an extent that markets for petroleum products are hurt now when business or industrial activity slows down.

A few observers have worked out a definite correlation between changes in GNP and changes in domestic gasoline demand. These economists, for example, figure that each $100-million a year increase in GNP will generate a 5,000 bbl. daily increase in gasoline demand.

That's why the optimism about 1958 business generally carries through to the oil industry. With the gross national product due for a healthy jump and industrial activity on the upgrade, oil is expected to share the gains.

Economists also add other ingredients of optimism to the 1959 picture. Government and consumer spending, employment, population are all rising.

Typical of the more optimistic predictions is that of the economic department of a large company. These men expect general business to be about 10% better in the first half of 1959 and about 3-4% better in last half of the year. They expect GNP in 1959 to average $465 billion, the FRB index to gain 9% to an average of 146, domestic petroleum demand to go up 6%.

This company's breakdown of GNP is typical. It predicts investment outlays, mostly in inventory change, to rise $12 billion or 23.1%, government purchases to rise $2 billion or 2.2%, and consumer spending to go up $16 billion or 5.5%.

Largest volume of consumer spending will go for services, with the largest percentage increase in the purchase of durable goods. Tops in the durable goods category are new car registrations, expected to hit 5.9 million for a 22.9% gain.

Another large integrated company is a bit more cautious in its prediction. This company's economist thinks GNP in 1959 will average somewhere between $457 and $460 billion and the average FRB index will rise to 143, the level held in 1957. He sees a domestic petroleum demand gain of

only 3.8% and new car registrations of only 5.5 million.

Three other majors predict domestic demand gains of 4%, 4.7% and 5.1% respectively.

**Natural gas . . .** At least one economist is showing open concern at the inroads of natural gas into oil markets.

This economist has made a special study of total income derived by producers in the oil and gas industry. It shows that total income from crude oil, natural gas, and condensate has been declining in the last few years, and the future trend is downward.

His explanation: Cheaper gas is cutting into markets for higher-priced oil.

The comparative prices paid for these competing fuels in home heating illustrate this economist's point.

Natural gas sells in Washington for $1.35 an M.c.f. The average cash flow back to the producer from this sale is about 11.3 cents an M.c.f., or less than 10% of the retail price.

With heating oil priced at about 15 cents a gallon, the home owner pays $6.30 a barrel. From this, the producer nets back about $3 a barrel or nearly 48% of the retail price. This $3 compares with a net back of about 68 cents for the barrel equivalent of natural gas.

The comparative prices will vary from region to region, but the comparative netbacks to the producers remain nearly constant.

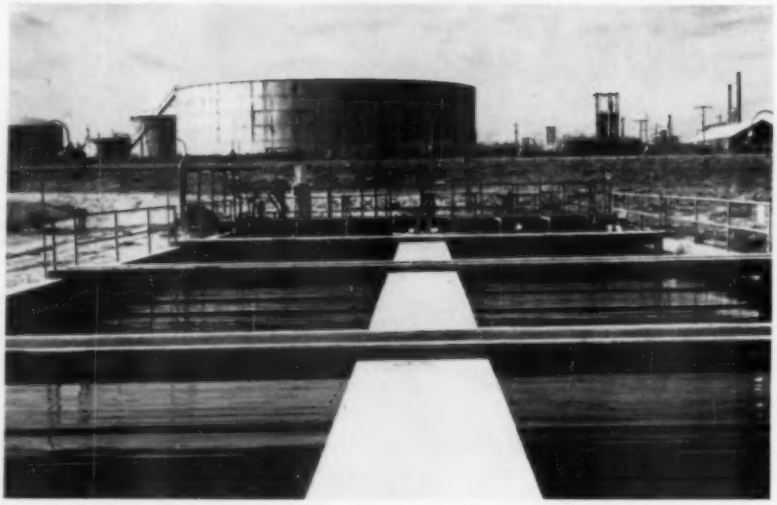
This economist blames the oil industry for much of this condition. He cites some areas where natural gas is taking markets away from oil when the relative retail costs are nearly equal. The gas distributors have outpromoted, out-advertised, and outsold fuel-oil distributors, he said.

Only recently have a few oil companies in the east and north started to advertise and promote their heating oils. The big emphasis heretofore has naturally been on gasoline. But the heating-oil market is becoming so important to oil distributors, refiners, and producers it should be developed.

**Equipment outlook . . .** Preliminary reports indicate that drilling will show a gain in 1959 over the 1958 rate.

Just how much this may be won't be determined until companies complete their exploration and drilling budgets. One economist reports he has compiled charts showing that drilling and equipment sales move with the general economy. On this basis he expects drilling and supply business to pick up in 1959.

And for this segment of the oil industry the 1959 pickup can't come too soon.



**1** SEPARATOR takes water from throughout the refinery, including boiler blowdown and storm water. Oil is separated and waste water flows to . . .

**4** UNDERWATER BURNER controlled from house in photo steadily adds carbon monoxide to reduce alkalinity. Water then flows into one of a series of . . .

# Champlin Well Satisfied

**• Biological-oxidation system recovers 2,000 bbl. of oil a month, is making friends among farmers and sportsmen.**

CHAMPLIN Oil & Refining Co. is convinced it never spent $185,000 to better purpose than for the new biological oxidation system it installed to dispose of wastes from its refinery at Enid, Okla.

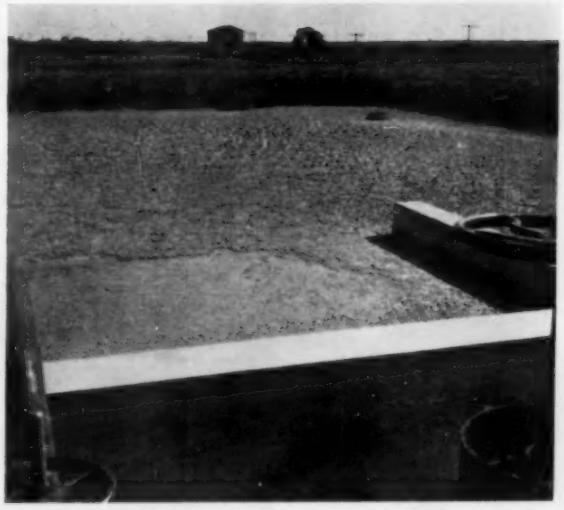
The system is the first of its kind in Oklahoma and one of the first operated by an independent anywhere. It has some features that are entirely new.

The system has been operating perfectly for several months. Since it went on stream, Champlin has been busy hosting disposal experts from other refineries.

Along with recognition as a pioneer, however, Champlin is gleaning other benefits—some of them direct, some indirect but just as desirable. For instance, the new system is:

. . . **Recovering oil** from waste water at a rate of about 2,000 bbl. a month, the equivalent of a good oil well. Before the system was built, a lot of this oil was burned.

2 AERATION POND where remaining oil is removed and water reaches uniform makeup. It moves to . . .



3 LIME SETTLING PITS, where treatment removes last traces of oil, then into a small pond where . . .

5 OXIDATION LAGOONS, where bacteria reduce phenol and sulfide contaminants. Water then leaves via . . .

6 PASTURE STREAMS, which carry water 2 miles to Boggy Creek. Vegetation testifies to system's efficiency.

# With New Refinery Disposal System

. . . **Reaping good will** from sportsmen, farmers, and stockmen. The Oklahoma Department of Wildlife Conservation, for instance, praised the project lavishly in a feature in its magazine, "Oklahoma Wildlife."

. . . **Wiping out flood threat.** Many disposal systems that normally work well are overwhelmed during periods of floods or heavy rains and pollute fresh-water sources in the refinery area. At Enid, refinery men no longer feel uneasy when the rains come.

The system was designed by Don Perkins, chief chemical engineer (photo 6), and Vern Slusher, chief refining engineer. They also supervised construction of the system.

Champlin is the first refiner to use an underwater burner in a disposal system to reduce alkalinity. The burner, an eight-fingered, thermocouple system, burns a gas and air mixture. It employs an electrical igniter and is fed by a small compressor in the burner-control house (photo 4).

The Champlin system is also unusual in that it is one of the first to go so far as to treat boiler blow-down water.

Farmers in the Enid area benefit in many ways from the Champlin system. Their crops don't fail due to soil soured by oil-polluted irrigation water. Their cattle don't die from drinking such water. These they take for granted.

There is another benefit, however, that the farmers don't take for granted. Due to company efforts, local wheat farmers are getting free fertilizer.

At little cost to itself, the company periodically trucks excess lime sediment, obtained when it cleans its disposal-system lime pits, to an accessible area near the plant. Farmers are invited to pick up the lime for farmland fertilizer.

# Deep Kenai Zone Tapped

## . . . in new California Standard Swanson River producer. Alaska Land Board adopts leasing policy for state lands.

A GOOD, NEW producing zone has been discovered by Standard Oil Co. of California on the Swanson River Unit of Alaska's Kenai Peninsula.

California Standard found the zone at 11,038-60 ft. in the 2 Swanson River Unit well. It flowed at the rate of almost 500 bbl. daily on a 2-hour test.

In the test, a 3,000-ft. water cushion surfaced in 1 hour, 55 minutes. Oil surfaced in 2 hours, 35 minutes. The crude tested 28.7° gravity.

Crew has temporarily bridged off the new producing formation while tests are made of the nonmarine Eocene Hemlock sands at 10,804-78 ft. The 1 Swanson River discovery well was completed in the Hemlock at 11,150-11,215 ft. for 500 bbl. daily.

California Standard originally spudded the second well more than a year ago. After reaching total depth of 12,046 ft. earlier this year, the 2 Swanson River Unit was suspended. The rig was moved to 3 Swanson River, which proved to be a dry hole.

The Coastal Drilling Co. rig then was moved back to 2 Swanson River for the current testing. When this is completed, the rig will be moved northwest to the 4 Swanson River location.

California Standard is operator on the 71,000-acre unit for itself, Richfield Oil Corp., Union Oil Co. of California, and Ohio Oil Co.

**New leasing policy . . .** The Alaska Land Board, meanwhile, has adopted new rules and regulations for leasing state lands.

The new state will have control over 104,000,000 acres which it may select from the federal domain over the next 25 years.

High points of the new policy:

**. . . Acreage limitation** is 100,000 acres under lease or 200,000 under option.

**. . . Tide and submerged lands** will be put up on competitive basis.

**. . . Known or producing** geologic structures will be competitive. Classification will be determined by USGS or through additional geologic information offered at public hearings.

**. . . All other uplands** will be noncompetitive.

The board also decided that existing federal offers on noncompetitive acreage will be honored by the state.

Federal lease offers on land which later is held to be on a known or producing geologic structure may be honored at the discretion of the board.

The board also indicated it will have the authority to enter into operating and development contracts involving larger tracts than 100,000 acres.

The new policy, however, is expected to be examined by the Alaskan legislature which opens its first session January 26. The lawmakers may write some changes.

**Popular hearing . . .** The mid-December hearing at which the board adopted its tentative rules was a popular attraction to oil-company representatives and Alaskans interested in the oil play.

About 40 oil companies were represented. Board Chairman Phil Holdsworth announced the new policy at the close of the hearing. The rules parallel most of the suggestions made by major company representatives. One exception was the argument by Humble Oil & Refining Co. that all state lands be put up for competitive bidding. The board decided on a classified policy.

# Pipeline Victors

## in first round of Kansas Hugoton field gas battle.

THE KANSAS Supreme Court may become the final arbiter in an important legal battle between the Kansas Corporation Commission and several pipeline firms over gas allowables for Hugoton field.

The pipelines won the first round last week. District Judge Roland Tate of Garden City, Kans., declared void the Hugoton gas allowable orders since May 1956.

But members of the corporation commission have announced they plan to appeal Tate's decision to the Kansas Supreme Court. Royalty owners also may file motion for a new trial as part of the legal maneuvers attempting to overturn the ruling.

The decision, if allowed to stand, will stop the commission's 2-year efforts to increase the gas takes from the Kansas portion of the three-state Hugoton field.

**The argument . . .** The commission and royalty owners claim that pipeline companies are taking much more gas from Oklahoma and Texas portions of Hugoton than from Kansas.

This has lowered field pressures in Oklahoma and Texas. The ultimate result will be migration of gas from Kansas into the other states unless

gas takes from Kansas are stepped up.

Economic force behind this preference for Oklahoma and Texas gas, officials claim, is price. Kansas prices in Hugoton average higher than those in the other states.

To increase Kansas takes, the commission devised a new policy in determining allowables. The commission considered over-all gas markets, all sources of supply, and production rates in other fields in setting Hugoton allowables. Previously, nominations by pipelines had been the governing factor.

A new policy of handling overages and underages also was announced. Under it, a producer with excessive underage lost it and the unused allowable was distributed among other producers.

Most of the major pipelines connected to Hugoton field opposed the moves. Panhandle Eastern was the lone exception. Colorado Interstate Gas Co. brought the district court suit which resulted in the decision against the commission.

Pipeline firms charged the commission is violating constitutional guarantees and the Kansas conservation law and is invading the regulatory field of the FPC.

## Ringwood Hearing

### dates postponed to permit gas deliverability tests.

FURTHER tests are being conducted in Oklahoma's Ringwood field, setting the stage for an unusual hearing next month before the Corporation Commission.

The hearing—which involves the question of whether a state commission can void a firm contract on the ground that a low price constitutes economic waste—is now set for January 20-23.

Previously scheduled for December 18 and 19, it was postponed to permit deliverability tests of all Cherokee-zone gas wells in the field, located in Major County.

The tests, to determine ability of the wells to produce against flow-line pressure, started last Thursday and were to wind up December 22.

Bottom-hole pressure tests were conducted on both Cherokee-zone and Manning-zone wells after the 225 wells in the field were shut in November 20 by order of the commission (OGJ, Nov. 24, p. 50).

Ferrill Rogers, the commission's conservation attorney, requested the shutdown, contending the contract price of 2 to 3 cents per M.c.f. for the gas is causing ecnomic waste.

## watching WASHINGTON

Joe Reilly

### • Coal sees bright side to Memphis ruling . . .

THE COAL INDUSTRY, which is fighting a rear-guard action to slow the invasion of its markets by natural gas, was not too unhappy over the Supreme Court's reversal of the Memphis decision.

True, coal producers see the Supreme Court ruling as a victory for their competitors. But the victory revives the hope that gas prices will seek their competitive level.

Higher or "more realistic" gas prices would give the coal industry a better chance to hold present markets. And, the gas industry contends, higher prices would benefit the consumer by assuring an abundant fuel supply.

In a recent policy statement, the National Coal Association pointed out that the combined efforts of competing fuel industries are needed to meet America's present and future needs.

"For wise use of America's fuel resources, the federal Government should encourage the most efficient utilization of available energy supplies through appropriate legislation and equitable administration of the law," the statement continued. "The public interest is not served by the dumping and the off-peak sale of natural gas in industrial and commercial markets at prices unfairly designed to displace competitive fuels."

Many in the petroleum industry would agree with the statement, up to that point, at least. In fact, it sounds as if it might have been written by a refiner who was having a hard time getting rid of fuel oil.

### • Public airport bill could boost asphalt . . .

ASPHALT MANUFACTURERS, who are getting a lot of lip service, if not contracts, for Air Force runways, may fare a little better under the anticipated federal-aid program for construction of public airports.

Sen. A. S. Mike Monroney (D-Okla.), plans to renew his drive in Congress for a big airport-improvement program. He helped pass a federal-aid airport bill this year, but it was vetoed by President Eisenhower.

The bill sought by Monroney would provide federal funds on a 50-50 matching basis for airport construction and improvement at the rate of $100 million a year. The program would continue through fiscal 1963.

The President favors "an orderly withdrawal from the airport grant program" by the federal Government. But the administration, he indicated, will recommend federal aid for "urgent" projects. Runways are expected to have high priority in the administration program.

Whatever form the legislation takes, it is likely to give asphalt a better chance to compete for runway jobs than the Air Force has been willing to grant.

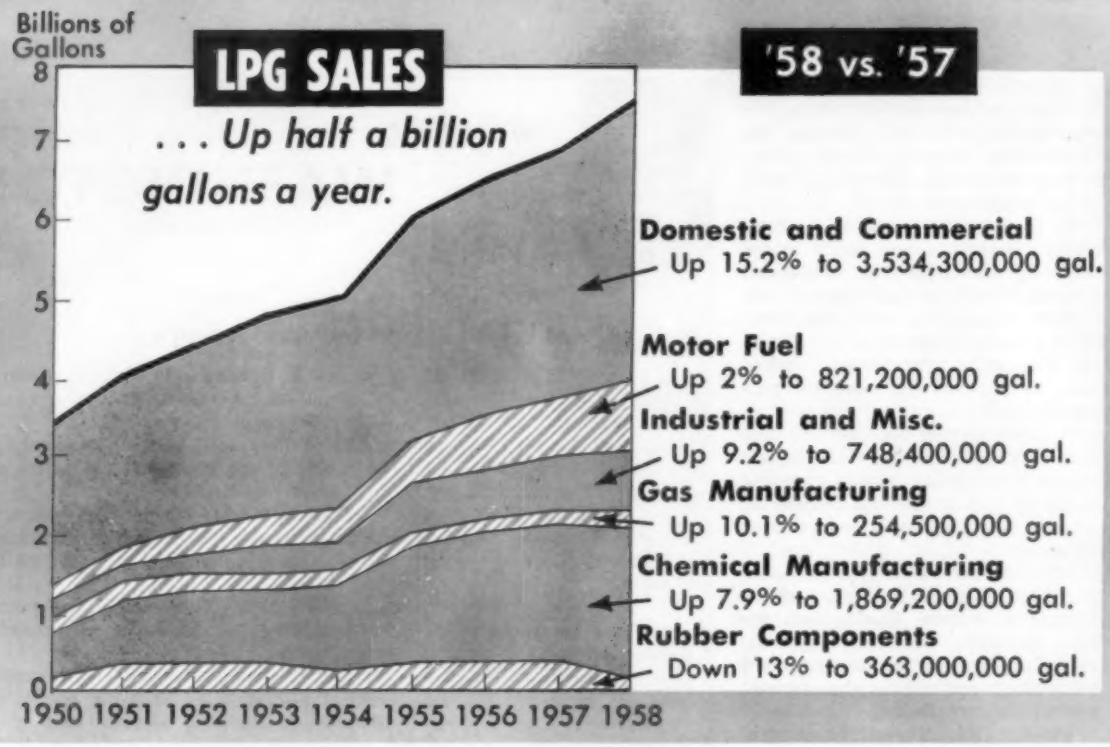
### • Election set, unions eye offshore workers . . .

ORGANIZED LABOR may step up its efforts to bring offshore drilling crews into the union fold. The big Oil, Chemical and Atomic Workers International Union is trying to get an offshore foothold in California.

The National Labor Relations Board has ordered an election to determine representation rights for Santa Barbara employes of Sun Marine Drilling Corp. Eligible employes, excluding clerical workers, tool pushers, watchmen, guards, and supervisors, will have the choice of being represented by OCAW, International Union of Operating Engineers, or neither.

Drilling operations will be more centralized off California than in the Gulf of Mexico. Hence, West Coast crews are considered better targets for union recruiting.

Organization drives by other unions, both in the gulf and in inland regions, have been disappointing to labor leaders. Outcome of the Santa Barbara election will affect future organization drives.




# LPG Hangs Up New Record in '58, Will

• For several years ahead, in fact, there's little but optimism for the LPG industry. More product will be needed by chemical firms, for farm and home uses, and in gasoline blending. Many summer markets still are unexploited.

MOUNTING demands for LPG, mainly in house heating, gasoline blending, and chemical manufacturing, paint a rosy picture for LPG producers.

Sales this year are setting an all-time record and will top 7½ billion gallons.

What's more, this year's increase of 652,300,000 gal. over 1957 is 30% greater than the average annual increase of the last 9 years.

Total sales this year are expected to reach 7,591,400,000 gal., up a solid 9.4% over last year.

These are the estimates of Phillips Petroleum Co. in its annual year-end summary of LPG sales and prospects. The 1958 study was prepared by George R. Benz, engineering department manager; W. F. DeVoe, manager of LPG sales, and Paul W. Tucker, technical representative.

**The outlook . . .** This year's increased demand developed in spite of a reduced level of business.

With the economy now trending upward, "there is every indication that 1959 will be another good year," the report says.

There's a growing market in both heating and air conditioning, sparked by the trend toward suburban living and the bright prospects for new home construction.

Too, says Phillips, there are still untouched summer "load builders." These include crop drying, flame weeding, tractor fuel, asphalt heating, and aggregate drying.

With present markets growing and new markets in prospect, the upward trend in sales should continue.

**The weather . . .** The weatherman holds an important, unpredictable balance of power in LPG consumption.

A cold spell last February and March, which left southern and southeastern U. S. shivering, caused a rush for an extra 230 million gallons of LPG. That frigid blast accounted for about one-half the total domestic increase this year.

Playing no favorites, heavy rainfall in principal irrigation areas caused a drop in use of farm pumps.

The hula-hoop craze affected LPG usage. Feed stock for polyethylene manufacture is the most rapidly growing chemical market for LPG. And some 16,000,000 of the hoops were made of polyethylene.

**Motor fuel . . .** Substantial gains were made in use of LPG in ready-mix concrete trucks, taxicabs, industrial lift trucks, farm tractors, cargo refrigeration and in small fleet trucks.

Materials-handling equipment emerged as the fastest growing individual market for this motor fuel. Reduced oil-well drilling resulted in less LP-gas use for this purpose.

**Chemicals . . .** Sale of LPG as a raw material for making chemicals and chemical intermediate gained 136.9 million gallons in 1958.

A marked increase in ethylene production from butane and propane, as compared to production from ethane or recovery from refinery gases, was reported.

**Other gains . . .** LP-gas range sales

## Here's How LPG Sales Have Increased

(In Thousands of Gallons)

| Year | Total Volume | Total Per cent Increase | Domestic and Commercial* | Motor Fuel | Industrial and Misc. | Gas Manufacturing | Chemical Manufacturing | Rubber Components |
|---|---|---|---|---|---|---|---|---|
| 1922 | 223 | .... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1925 | 404 | 7.2 | ..... | ..... | ..... | ..... | ..... | ..... |
| 1928 | 4,523 | 314.6 | 2,600 | ..... | 400 | 1,500 | ..... | ..... |
| 1930 | 18,017 | 81.4 | 11,800 | ..... | 2,200 | 4,000 | ..... | ..... |
| 1935 | 76,855 | 36.2 | 21,380 | ..... | 47,894 | 7,581 | ..... | ..... |
| 1937 | 141,400 | 32.6 | 40,823 | ..... | 62,610 | 11,175 | 26,792 | ..... |
| 1940 | 313,456 | 40.2 | 134,018 | ..... | 124,482 | 20,285 | 34,671 | ..... |
| 1944 | 1,060,156 | (†) | 445,617 | ..... | 254,590 | 45,879 | 151,985 | 162,085 |
| 1945 | 1,276,766 | 20.4 | 533,262 | ..... | 256,577 | 53,849 | 224,291 | 208,787 |
| 1950 | 3,482,567 | 22.8 | 2,022,464 | ‡129,818 | 225,638 | 251,694 | 624,468 | 228,485 |
| 1951 | 4,227,275 | 21.4 | 2,166,813 | 289,991 | 269,408 | 281,692 | 844,507 | 374,864 |
| 1952 | 4,477,379 | 5.9 | 2,266,178 | 370,558 | 338,959 | 259,697 | 870,990 | 370,997 |
| 1953 | 4,932,009 | 10.2 | 2,479,180 | 498,238 | 374,233 | 222,430 | 967,427 | 390,501 |
| 1954 | 5,125,533 | 3.9 | 2,626,808 | 547,204 | 401,615 | 191,932 | 1,050,239 | 307,735 |
| 1955 | 6,122,718 | 19.5 | 2,801,379 | 651,821 | §556,371 | 213,760 | ¶1,493,177 | 406,210 |
| 1956 | 6,635,763 | 8.4 | 3,001,021 | 773,471 | 630,273 | 212,293 | 1,600,604 | 418,101 |
| 1957 | 6,939,121 | 4.6 | 3,067,070 | 805,056 | ‖685,313 | 231,155 | 1,732,338 | 418,189 |
| 1958 | 7,591,400 | 9.4 | 3,534,300 | 821,200 | 748,400 | 254,500 | 1,869,200 | 363,800 |

*Heating and other household and farm uses. Includes LPG sold by distributors for commercial or industrial uses. †Not comparable due to inclusion of rubber components. ‡Included in industrial and miscellaneous before 1950. §Includes more complete coverage of refinery fuel. ¶Includes more complete coverage of LPG streams containing ethane and methane. ‖Includes use for secondary recovery.

**IN THE TABLE,** 1958 figures are Phillips estimates. Total sales for all other years were obtained from U. S. Bureau of Mines reports, as were distribution figures for the years 1935 through 1957. All other figures are Phillips'. The figures do not include butane blended with heavier fractions into gasoline.

## Repeat in '59

reached an estimated 355,400 or 20% of home gas-range sales.

This fuel fired 11% of all new water heaters sold, 25.8% of floor furnaces sold, and 15% of all U. S. sales of vented, recessed wall heaters.

Use of LPG in secondary recovery of crude oil increased an estimated 20% over last year. Much of the volume "used" in these operations will be "produced" again.

Gas utilities used an estimated 254,500,000 gal., better than 10% increase over 1957.

These companies show a continuing interest in aboveground and underground storage facilities. Available underground storage capacity was placed at 1.6 billion gallons, up 20% over last year. Another 100 million gallons of capacity is under construction.

**New facilities . . .** Thirteen new natural-gasoline plants and refineries should be on stream in 1959.

One new ocean-going tanker is under construction, scheduled for delivery in early 1959. Three new inland waterway barges were placed in service this year.

Dips in new automobile production were reflected in decreased use of LPG in the synthetic rubber industry.

## LPG Price Hits 10-Year High

### . . . as cold wave kicks up demand, turns inventory buildup into a nose dive. New price level: 5.5 cents per gallon.

SEVERE winter weather, bringing a sudden—and welcome—spurt in demand, last week moved LPG prices up half a cent a gallon.

The cold wave tightened an already firm market in which the going price already was at last winter's 5-cent peak.

The new price puts LPG f.o.b. Oklahoma City at 5½ cents a gallon, highest since the 6.6-cent level reached in 1948. The ½-cent increase applies to butane, propane, and mixtures of the two in all areas except the East Coast.

While subfreezing temperatures over the country triggered the increase, growing underground-storage capacity played a part.

An unusual 1-cent increase in August had been threatened by continued low demand in autumn. But ample space in underground caverns allowed suppliers to run product to storage and avoid a market glut.

As a result, there was a 5-cent prevailing price ahead of cold weather, in spite of a warm November.

Another factor in this year's strong market is the steady annual growth of LPG demand (see opposite page). Although stocks on December 1 were higher than last year, the inventory gain did not match the demand gain.

During the first 9 months of 1958, demand was 10% higher than last year's, according to the Bureau of Mines. Warm weather in October and November will cut the increase for the year.

**Inventories . . .** The widespread cold wave this month is expected to knock stocks down sharply.

The annual buildup this year got off to a late start because of unusually cold weather and a heavy demand in January. Stocks lagged behind 1957 until the end of October.

But warm weather in November, when the drop usually starts, sent more LPG to storage, and at the end of the month propane stocks amounted to 651,500,000 gal., 36,500,000 gal. above 1957. The spread, however, was insignificant in view of the expected increase in demand.

**PLASTIC PIPE** is transported on 14-ft. spools.

**PIPE** rolls quickly off spool onto ocean floor.

# New-Type Plastic Pipe Tested in Gulf

**• Reinforced, flexible tube will move crude to offshore production platform. Shell finds laying job is easier, but it's saying nothing now about costs.**

PLASTIC PIPE that reels off a giant spool is getting a full-scale test in the waters off Louisiana.

Shell Oil Co. and British Insulated Calenders, Ltd., of Manchester, England, are making the first test of the easy-to-lay flexible pipe in a marine oil field.

Cost of the pipe is being kept under wraps. Admittedly, the cost of the current experiment is running high.

Also there has been one mishap so far. Part of the test pipe had to be reeled in because of leakage.

Plastic pipe has two big advantages:

**. . . It is flexible** and is less affected by waves, currents, and variations in the ocean floor than conventional pipe.

**. . . It can be laid** easily and quickly.

**The test . . .** Shell and BIC have laid 900 ft. of the new pipe in Shell's South Pass, Block 27 field, off Plaquemines Parish.

It extends from Well No. 33 on State Lease 1012 to the Block 27 Production Platform "M."

The pipe is a 3-in. plastic tube wrapped in steel tapes and insulating materials to an outside diameter of 4½ in. While the tapes give strength to the plastic, they also preserve flexibility.

The pipe weighs 12.2 lb. per foot and is designed for 2,000 psi. working pressure. It is heavier than steel pipe of the same dimensions, and this makes it unnecessary to weight the pipe to the ocean floor. Brown & Root, Inc., laid the pipe.

The shipment from England consisted of two 14-ft. reels holding 1,100 ft. of pipe each. Lykes Brothers Steamship Co., which brought the reels from England, estimates that eight times the cargo space would have been required for the same length of steel pipe.

**Advantages . . .** Shell engineers say the plastic pipe is particularly valuable in deep-water operations because no heavy equipment is needed to lay it.

Its flexibility permits a sharp drop from the laying barge to the water floor, and it reels off quickly.

Brown & Root required only 30 minutes to put the 900 ft. of test pipe into 35 ft. of water.

The reels were mounted on an axle, and the pipe unwound easily into the water. When the desired length was out, a hacksaw was used to cut the pipe. Installing the connections took much longer.

**Past use . . .** As far as Shell and BIC engineers know, this is the first use of plastic pipe in an offshore oil field.

However, this is not the first time

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it has served as an underwater line for transmission of oil.

During World War II, BIC laid 60 miles of plastic pipe across the English Channel to supply the Allied armies with fuel.

This pipe, however, was expendable. The important thing at that time was to move the fuel to the continent, regardless of losses.

Principal question to be answered by the current test is whether the pipe will prove dependable and economical in full-time use for offshore production.

## Washington Active Again

WASHINGTON'S only oil well, the 1 Medina, is being reworked by Sunshine Mining Co.

Sunshine hopes to boost production to the 70-bbl. daily rate recorded when the well was completed in the fall of 1957. It is near Ocean City in Gray's Harbor County.

The company also hopes to establish production in an abandoned hole nearby. It plans to deepen the 4 Hawksworth, drilled by Union Oil Co. in 1951 half a mile south of the 1 Medina.

This well caused excitement when it tapped three high-pressure gas sands and flowed 47°-gravity oil on a short test. Technical difficulties forced abandonment.

Sunshine believes another 800 to 1,000 ft. should reach the Miocene, which produces in 1 Medina at 3,952-58 ft. The Union test was bottomed at 3,711 ft.

## Blackfeet Indian Land Leased

MAJOR oil companies bid a total of $1,611,429 for 25,500 acres of Blackfeet Indian Reservation land at a recent sale in Browning, Mont.

The 45 tracts directly offset the east boundary of Glacier National Park, where oil development is prohibited. Most of the bidding was on leases in a strip 2 miles wide and about 16 miles long extending from the Alberta boundary southeast to the town of St. Mary's.

Some of the world's largest gas fields lie along the mountain front in Alberta just north of the Indian acreage.

The California Co. was high bidder, offering a total of $706,906. Calco also submitted the highest per-acre bid, $238 an acre on one tract. Shell Oil Co., Gulf Oil Corp., and Pan American Petroleum Corp. jointly bid a total of $684,020. Bids offered individually by Shell amounted to $135,934. The Texas Co.'s bids totaled $81,961.

# Mandatory Controls Urged

### . . . by Texas imports-study group. Report blames imports for lower allowable, economic woes, and big tax loss.

EXCESSIVE oil imports are damaging the Texas economy to the tune of $2,000,000 a day.

Furthermore, the state will have lost roughly $40,000,000 in the 2 years ending August 31, 1959, in oil severance-tax revenues due to the depressing effects imports have had on Texas oil production.

This is the crux of the final report sent to Price Daniel, Texas governor, by a commission named by him nearly a year ago to study the oil-import situation and its effects on the state economy. The commission held public hearings during the past year in Austin, Abilene, Corpus Christi, and Midland (OGJ, Nov. 24, p. 54).

**Recommendations . . .** The report urged action on two fronts.

On the national level, it recommended that the governor, legislature, and Texas congressional delegation press the president to use his existing powers to impose mandatory controls on imports. If the president should delay beyond January 1, the state should support legislation requiring him to set up such a program, the report said.

Within Texas, the commssion authorized its legislative subcommittee to determine what legislation is needed to correct what it called "anticompetitive practices of importing companies." The subcommittee is headed by Guy Warren, independent producer of Corpus Christi.

The commission found that the "domestic oil producing industry is in its worst condition since the depression of the 1930's, and it continues to deteriorate."

Uncontrolled imports of crude and products would completely destroy it, both in Texas and over the nation generally. Imports under the current so-called voluntary program, the report said, are excessive and are "seriously endangering the domestic industry and security of the nation."

The commission put the finger on such excessive imports as being "the major contributing factor" in:

. . . **Cutting state oil output** to an average of only 10 producing days per month during 1958.

. . . **Causing widespread unemployment** in the oil and related industries.

. . . **Slashing exploration,** drilling, and development.

. . . **Damaging conservation** by largely nullifying state laws relating to market-demand proration, ratable take, and prevention of waste.

# Dodecene Moves by Pipeline

### . . . from Ponca City to Wood River. Trail-blazing tender means transportation savings for Conoco in the future.

DODECENE, a refinery product used in detergent manufacture, has made its first long trip by pipeline.

Continental Oil Co. has shipped the petrochemical 500 miles over the affiliated Cherokee Pipe Line system from Ponca City, Okla., to Wood River, Ill.

Dodecene, or propylene tetramer, is made in the catalytic polymerization unit at Conoco's Ponca City refinery. From the Wood River terminal it is barged to the Conoco refinery at Lake Charles where it is alkylated with benzene to produce detergent alkylate (dodecyl benzene).

Detergent alkylate is further processsed and shipped to chemical plants to make detergent.

Formerly dodecene was shipped by tank car. Pipeline-barge handling offers the lowest cost means of transportation for a refinery product which is upgraded in petrochemical manufacture.

Cherokee completed a test shipment of 2,250 bbl. October 10. It proved the feasibility of batching dodecene in large quantities. Shipments of 20,000 bbl. are planned several times a year.

**Loss is slight . . .** Cherokee handles dodecene largely as it does other refined products. It is shipped between batches of premium gasoline. Normal mixing at the product interfaces results in loss of only 0.2% of dodecene.

Cuts between products are made to insure high purity of the petrochemical. But there is no waste to be diverted into slop tanks. Since dodecene is itself a high-quality gasoline component, the premium gasoline is not contaminated by interfacial mixing.

# Texas Keeps 12-Day Allowable

## . . . for January, although new schedule is slightly above last month. Most major purchasers sought a reduction.

TEXAS will stay on a 12-day oil-producing pattern in January.

The Texas Railroad Commission last week decided in favor of retaining December's 12-day schedule, the highest level reached in 1958, over the wishes of most of the major crude buyers.

The commission set the initial allowable for January at 3,128,366 bbl. daily, This is slightly under December's initial figure of 3,147,506 bbl. daily due to schedule corrections early in the month for unused allowable. It represents a small increase, however, over the 3,112,411 bbl. schedule in effect December 6 due to production from new wells.

**ALLOWABLE BY DISTRICTS**

| District— | December | Change from Dec. 6 |
|---|---|---|
| 1—Southwest | 52,926 | 480 |
| 2—Gulf Coast | 125,727 | 550 |
| 3—Gulf Coast | 425,282 | 1,566 |
| 4—Southwest | 217,968 | 148 |
| 5—East Central | 35,393 | 68 |
| 6—Outside East Texas field | 133,719 | 110 |
| 6—E. Texas field | 16,426 | .... |
| 7-B—N. Central | 182,583 | 1,095 |
| 7-C—W. Central | 153,289 | 878 |
| 8—W. Texas | 1,229,646 | 8,159 |
| 9—N. Texas | 270,553 | 1,954 |
| 10—Panhandle | 137,854 | 1,083 |
| TOTAL | 3,128,366 | 15,955 |

**What was asked . . .** Only two of the major crude purchasers in the state, Humble Oil & Refining Co. and The Texas Co. were bullish.

Humble sought 12 days, Texaco 13. All of the 11 remaining firms making nominations asked for an allowable reduction, with five asking 11 days, six only 10.

Independents this month were content to rely on the commission's discretion and made no January recommendation.

One of the biggest crude buyers, Gulf Oil Corp., was in the low 10-day bracket due principally, it said, to shutdown of a process unit at its Port Arthur refinery.

Gulf's J. G. Coates told the commission Gulf thinks crude stocks are too high at the present 257,000,000 bbl. despite industry testimony last spring favoring a higher level. The industry, he said, performed well earlier in the year when stocks were only 245,000,000 bbl. And this performance, Gulf thinks, speaks louder than the testimony last spring.

Texaco said "adjustments in West Texas" influenced it to up its nomination from 12 to 13 days to get the amount of crude it will need next month.

Humble, the state's biggest buyer, said it had continued to make heavy spot purchases of oil on Dec ember's 12-day allowable and expected to spot buy through January.

Two factors are credited with weighing most heavily in the commission's decision to maintain the high production rate despite adverse testimony.

There were:

**. . . A heavy drain** on distillate stocks during the past several weeks due to cold weather.

**. . . Lack of any proration** by pipelines throughout Texas. No crude in the state was reported without a market. Some North Texas oil appeared in danger when Ashland Oil & Refining Co. ceased its purchases in Baylor and Knox counties in favor of buying Kentucky oil closer to its refinery. But Humble stepped in to snap up the crude on a trade-out arrangement.

# *PROCESSING BRIEFS . . .*

**DuPont plans** to build a plant to produce linear polyethylene at its Orange, Tex., petrochemical works. The plant will use a low-pressure technique developed by the company's research department. Construction by the engineering department will begin soon. Completion is expected by mid-1960.

**Humble** has taken bids on construction of a giant cycling plant in the King Ranch area of South Texas. The plant will cycle gas caps of 24 separate reservoirs in four fields in three counties (OGJ, Sept. 15, p. 114).

It will be built in the Seeligson area and be designed to handle 300 million cubic feet of gas daily. A gathering system and pipeline to the Houston area also is in the plan. Bids closed last week.

**Construction is under way** of a natural-gasoline plant—the first to use gas-fired turbines for generating power and process heat—in the Laverne field, Harper County, Oklahoma. J. F. Pritchard Co., Kansas City, Mo., is contractor for the $3.5-million plant, which initially will process 100 million cubic feet of gas daily. Sun Oil will be operator for itself and 11 other companies. Completion is July 1959.

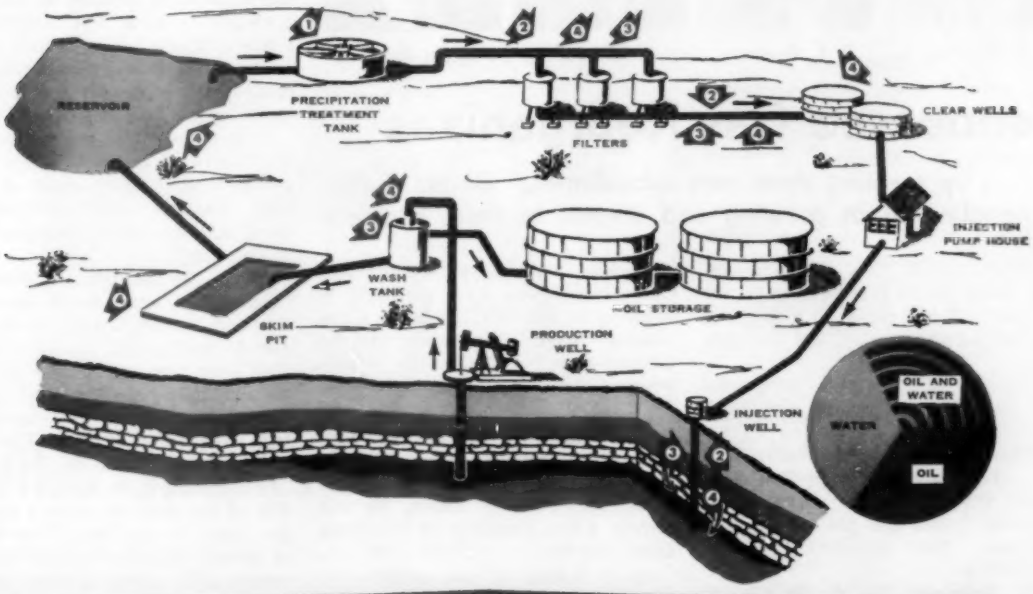
**Gas started moving** from Alberta's 8-year-old Cessford gas field with completion of Hudson's Bay and Canadian Delhi's new processing plant 100 miles east of Calgary. The field had been shut in since discovery in 1950. The refrigeration-type plant has a capacity of 125,000 M.c.f. daily. Dry gas is moving to Eastern Canada through Trans-Canada pipeline. About $8.6 million already has been spent on the field and facilities. Another $2 million will be spent on development wells. Currently 14 wells are producing.

## *Also for Refiners . . .*

**IN THE NEWS:** Domestic demand outlook for 1959 appears much brighter, oil-company economists report (p. 31) . . . Champlin has a smooth-working waste-disposal system at its Enid refinery (p. 32) . . . LPG sales set new record in 1958, probably will repeat in 1959 (p. 36) . . . Price of LPG hits 10-year high as cold weather kicks up demand (p. 37) . . . Texas study group is urging mandatory controls on imports (p. 39) . . . Texas keeps allowable at 12-day level for January (p. 40) . . . Researchers have developed the first automatic pilot plant (p. 52).

**PLUS THESE TECHNICAL REPORTS:** Gamma rays and X-ray films provide new way to detect corrosion (p. 64) . . . API analyzes changes in viscosity standards (p. 71) . . . Conical tube sheet combats refinery corrosion (p. 72).

# Continuous High Input with *Nalco* Water Flood Treatments

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Nalco polyphosphates or organic film forming inhibitors protect pipe lines and equipment against corrosive attack.

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Nalco stabilizing treatments keep scale-forming salts in solution and maintain clean lines and an open formation.

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Nalco microbiological treatments help maintain clean equipment and an open formation by controlling slime, algae and sulfate reducing bacteria.

Nalco Treatments for water flood operations add up to continuous high input, low pumping costs, elimination of acidizing and back flushing and lower over-all operating and maintenance costs. Check the diagram above for points where the Nalco System works to improve water flood efficiency... Your Nalco Field Service Man will be glad to work with you on any problems you have. His experience is backed by the entire facilities and skills of the world's largest water treatment organization.

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THE *Nalco*® SYSTEM . . . Serving the Petroleum Industry through Practical Applied Science

W. C. McGhee, Jr.

R. C. Graham

R. R. Dean

Harold Burrow

# Tennessee Gas Reorganizes

## . . . by creating three new subsidiaries. Object: Better handling of its growing and diverse business interests.

TENNESSEE Gas Transmission Co., which got its first pipeline permit in 1943 and has grown to a $1.2 billion corporation today, has reorganized.

It has formed three new companies and elevated three senior vice presidents to their presidency.

These are the new subsidiaries:

. . . **Tennessee Gas Pipeline Co.,** which will operate the parent firm's pipeline system and gas transmission business. The president: W. C. McGee, Jr.

. . . **Tennessee Gas & Oil Co.,** to handle oil and gas exploration and production for the parent firm and operate its oil and gas subsidiaries. The president: R. C. Graham.

. . . **Bay Petroleum Co.,** to manufacture and market petroleum products, wholesale and retail, for the parent firm and its subsidiaries. The president: R. R. Dean.

In addition, Harold Burrow, another senior vice president, was elevated to the new post of executive vice president of the parent company, which makes him second in command behind Board Chairman and President Gardiner Symonds.

Symonds, who has headed Tennessee Gas since its formative days, is chief executive of the three new divisions by serving as chairman of their operating policy committees.

All the new companies will headquarter in Houston with the parent company.

**Need for change . . .** Although its chief business is still gas transmission, TGT has branched out in recent years.

This diversification was a principal reason for the reorganization.

Tennessee Gas built its first pipeline from Texas to West Virginia in 1944 and had assets valued at $72 million at close of 1945. As of September 30 this year, assets were valued at $1,222,000,000.

Another subsidiary, Midwestern Gas Transmission Co., currently is applying to the FPC to build a gas pipeline from Tennessee to the Chicago area. N. W. Freeman is Midwestern president.

**Other changes . . .** The company also announced that Tennessee Life Insurance Co., a subsidiary, has a new president, Curtis M. Smith. He will remain a vice-president of Tennessee Gas.

L. C. Sonnen is new president of the Ten Ten Travis Corp., a subsidiary which owns and operates Tennessee Gas' real-estate holdings. He also is a TGT vice president.

Knowles Davis, director of rates, was named a new Tennessee Gas vice president and E. P. Priebe, assistant controller, became controller.

The changes do not affect Tennessee Gas's joint ownership of Petro-Tex Chemical Corp. with Food Machinery and Chemical Corp.

# Sale of UOP Stock

## by 200 underwriters at 5¼% "spread" due early in 1959.

IT LOOKS NOW as if Universal Oil Products Co. stock will go on sale late in January or early in February.

Guaranty Trust Co. told Referee Louis M. Loeb last week that, subject to court approval, it would meet with prospective underwriters later in the week to complete details.

It is proposed to register with the SEC early in January, which would permit sale to start about 3 weeks later. The sale would take possibly a week and should be completed early in February.

Some 200 underwriters, headed by Lehman Brothers, Smith Barney & Co. and Merrill, Lynch, Pierce, Fenner & Smith, will handle the sale. The three are expected to constitute the syndicate management group. The 200 will be selected to insure nationwide distribution of stock. The underwriters' "spread" will be 5¼%.

Provision will be made to set aside 5% of the stock to allow a stock-option plan for employes. This was one of several conditions prescribed by the court. The court directed that no buyer be sold more than 2% of the stock and that UOP service to present clients be continued.

Neither the number of shares nor the proposed price was agreed upon at last week's hearing.

Guaranty Trust Co. of New York is acting as trustee. The Guaranty Trust will merge with J. P. Morgan & Co., Inc., into the nation's fourth largest bank, it was announced last week.

# *PIPELINE BRIEFS . . .*

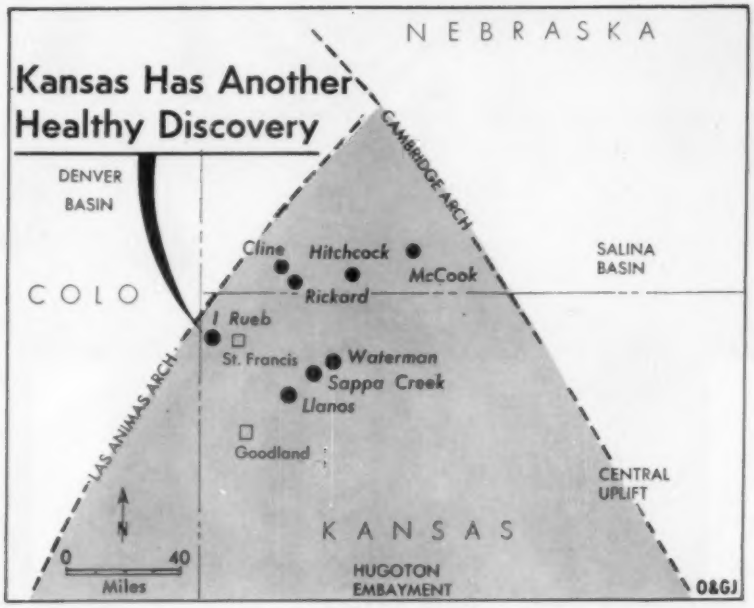
**Products deliveries** have begun to the Albuquerque terminal of West Emerald Pipe Line's 296-mile 6-in. line from Amarillo to Albuquerque. The Tucumcari terminal on the line, owned two-thirds by Shamrock Oil & Gas Corp. and one-third by The Texas Co., was opened in August. The line has capacity of 25,000 bbl. daily to serve markets in New Mexico and Arizona.

**A proposal to buy gas** from Atlantic Refining in the Mertzon area of Irion County, West Texas, has been filed with FPC by Pioneer Gathering System. Pioneer plans a 7-mile, 3-in. line to take oil-well gas which has been flared. Construction is scheduled to begin early next year.

**A 500-hp. pumping unit** was completed last week at Secretan, Sask., station on the South Saskatchewan Pipe Line. Company crews handled the installation on the crude system.

**A contract has been awarded** to Lake Construction Co. Inc., to build 8.7 miles of 6-in. and 2 miles of 4-in. to connect 10 leases in Port Acres field, Jefferson County, Texas, to Service Pipe Line. The gathering system will be able to move an additional 4,500 bbl. daily into the Service line by January 15.

Snelling Co. is laying 5 miles of 3, 4, and 6-in. to connect 12 leases in North Sandy Bend pool, Union County, Arkansas. The contractor also is laying 23 miles of 6 and 8-in. be-




# Strike Sparks New Play

## . . . on edge of sprawling Las Animas arch in northwestern Kansas. Drilling also boosted in Colorado and Nebraska.

A SUBSTANTIAL new discovery is adding stature to northwestern Kansas as one of the nation's newest oil provinces.

R. G. Lawton of Magnolia, Ark., swabbed 30 bbl. of oil an hour on a 2-hour test at his 1 Rueb. The perforated sections were Lansing-Kansas City (Pennsylvanian) at 4,515-25 and 4,537-44 ft.

The well is in Cheyenne County just east of the Colorado line in Section 13-3s-42w, about 30 miles from nearest production.

**Busy year . . .** The 1 Rueb apparently has opened the year's fourth pool in the Las Animas arch country of northwestern Kansas which was spotlighted earlier this year by a Phillips Petroleum Co. strike.

The 1 Llanos discovery of Phillips pumped 319 bbl. of oil daily from the Cherokee at 4,804-12 ft. An offset, the 1 Hartley-A, made 345 bbl. daily from Marmaton and later was dually completed with 289 bbl. daily also from the Lansing-Kansas City. The 2 Llanos made 120 bbl. daily from the Lansing-Kansas City, and the 3 Llanos will be completed in the Marmaton and Lansing-Kansas City.

The Llanos success immediately caused oil men to take another look at the potential of the area.

Two pools subsequently were tapped in Rawlins County, northeast of Llanos.

**Bigger game . . .** The Kansas successes actually could set off a bustling wildcat play rivaling activity in the northwestern Anadarko basin.

The Las Animas arch stretches from northeastern New Mexico across eastern Colorado and northwestern Kansas into southwestern Nebraska.

Geologists believe it may hide as much oil as the Central Kansas uplift.

The northern area was opened in October 1957 in Dundy County, Nebraska.

First production in the southern sector was brought in during 1952 at a Continental Oil Co. wildcat in Kiowa County, Colorado.

Interest in Las Animas arch exploration was waning until the Phillips' Llanos strike showed the possibility of major fields in the region.

This and other strikes have sparked an active drilling program. New drilling is under way in Kit Carson County, Colorado. More than a dozen rigs are busy in Thomas, Rawlins, Sherman, and Cheyenne counties, Kansas.

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tween the Fouke and Magnolia, Ark., stations, to be completed February 1. These projects are part of gathering-system expansions which will increase Service lease connections to 8,608 in its 15-state area.

**Thirty miles of 30-in. loop** for Texas Gas Transmission will be completed this week by Houston Contracting Co. The two segments of the project were near Alexandria and Bastrop, La. Next year 62 miles of 30-in. in Louisiana and Mississippi and 19 miles of 26-in. in Kentucky will be laid.

**Work will begin soon** on 30 miles of 30-in. loop for United Gas Pipe Line in Louisiana and Mississippi. Hallmac Construction Co., Houston, has the contract.

**Scurlock Oil** Co., Houston, is building a 15-mile gathering system in Motley County, Texas, to give Roaring Springs field a pipeline outlet. The new line, to be completed by year's end, will deliver about 500 bbl. of crude daily to a Service Pipe Line connection.

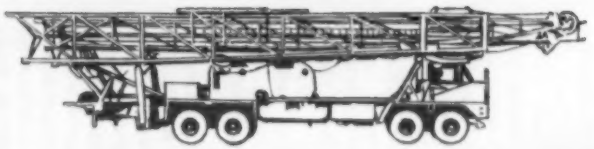
**Construction of 113 miles** of main line is planned by South Georgia Natural Gas Co. during the first half of 1959. The program includes four projects of 2, 3, 4, and 6-in. diameter. All are laterals from the main line to various cities served by South Georgia. No contracts have been let.

## *Also for Pipeliners . . .*

**IN THE NEWS:** Pipelines win first round in fight against high Kansas gas allowables in Hugoton field (p. 34) . . . Shell is experimenting with plastic pipe in offshore Louisiana operation (p. 38) . . . Petrochemical dodecene makes first long trip by pipeline (p. 39) . . . TGT reorganizes its company operations by forming three subsidiaries (p. 42) . . . California questions Transwestern Gas prices in hearing on new pipeline (p. 46) . . . Wabash nears completion of its new products line to Chicago (p. 51) . . . Texas Eastern gets permit for work which will provide new winter peaking service (p. 52).

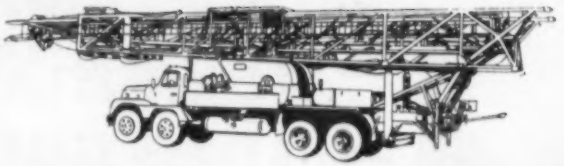
**PLUS THIS TECHNICAL REPORT:** Electronic computer checks compressor engine data (p. 67).

# FASTER PULLING
# FASTER MOVING
# FASTER SERVICE
# LONGER LIFE



## *Explorer*

New from wheels to crown. Power up to 400 HP. New main drum design for fast, safe pulling. New water and air cooling brake system. Models to 12,000 feet.

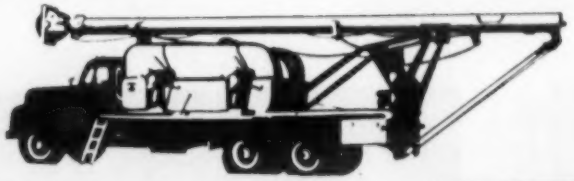


## *Rocket*

A singularly efficient and economical line with single or tandem front end. Three models with capacities ranging to 12,000 feet.

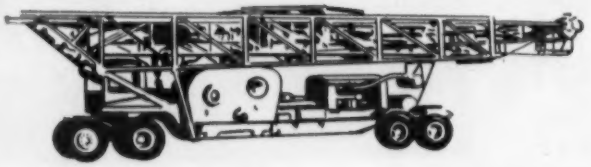
A FRANKS MODEL FOR EVERY WEL

L SERVICING AND WORKOVER NEED



*Cruiser*

The most widely accepted servicing unit in the field. Eight models, single or double pole masts. All balanced capacities to 12,000 feet.



*Clipper*

Self-propelled integrated units that head into location instead of backing in. Three models with servicing and workover capacities to 14,000 feet.

Franks gives you a unit to match every job in the field and then backs it up with 24-hour parts and field service.
You can depend on FRANKS.

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PAMPA, TEXAS
CABOT SHOPS, INC.

# Gas Prices Questioned

## . . . in hearings on Transwestern's proposed line to West Coast. California opposition could prolong FPC case.

CALIFORNIA consumer interests may insist that the Federal Power Commission take a "hard look" at prices to be paid for gas by Transwestern Pipeline Co.

Groundwork for possible opposition was laid last week as an FPC examiner opened hearings on Transwestern's proposal to build a 1,200-mile pipeline system to deliver up to 350,000 M.c.f. of gas per day to the rapidly growing California market (OGJ, Dec. 15, p. 65).

The price question was raised by Franklin & Campbell, representing the state, and by Henry E. Jordan, spokesman for the Long Beach Bureau of Franchises and Public Utilities.

Both said they favor an additional gas supply for southern California, but they reserved the right to object to the prices which Transwestern has contracted to pay producers.

If the price issue is pressed it may prolong the case, as it did when California objected to the 20-cent gas which El Paso Natural Gas Co. is buying in Aneth field, Utah.

In his opening statement, Campbell pointed out that at the present rate of growth California would have a population of more than 25 million by 1975.

Natural gas, now supplying an estimated two-thirds of the state's thermal energy, is expected to increase its share of the energy market.

**Price rise cited . . .** But, said Campbell, "as much as California wants and needs this gas, we want it at a reasonable price, not any price."

He said Californians "have become increasingly aware and increasingly alarmed over the fact that the price for this necessary commodity has spiraled upward and upward at a rate out of proportion to the moderately upward trend of all living costs.

"It does little or no good to regulate the pipeline company or the gas distribution company if the price allowed to the gas producers is not regulated and maintained at a level consistent with the public interest."

Campbell sought an order placing the burden of proof on the pipeline company and the producers to show that their rates are reasonable. The order was denied by Examiner Emery J. Woodall on grounds that plenty of time will be allowed for raising objections in future hearings.

**Study suggested . . .** Jordan noted that his "primary purpose" was to support Transwestern's plan.

But he raised the question whether the initial prices to be paid to the producers should not be subjected to a comprehensive study.

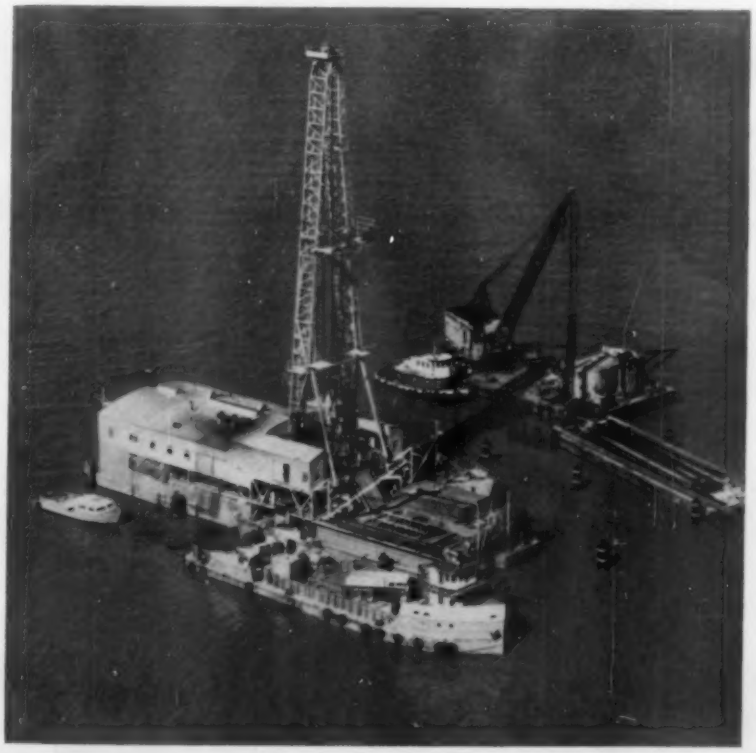
"Perhaps, in the past there has been insufficient reason to indicate any necessity for such procedure," he said.

"However, because of the unprecedented rapid increase in price of gas in the field during the past few years, it may well be that the time is at hand to take a good hard look at the cause of these increases to assure that the prices are both fair and reasonable."

**El Paso's views . . .** Anticipated objections from El Paso Natural, now the lone supplier of out-of-state gas to California, failed to develop.

Paul Kayser, El Paso president, indicated he has no plans to oppose the threatened competition from Transwestern.

Field prices offered by Transwestern for its gas supply range up to 23 cents per M.c.f. in some areas of Oklahoma and Texas. This figure is a record for the area and 5 or 6 cents above any price yet approved by FPC. Transwestern is said to have set a price several cents a thousand over going rates being paid by El Paso and other pipeline companies.



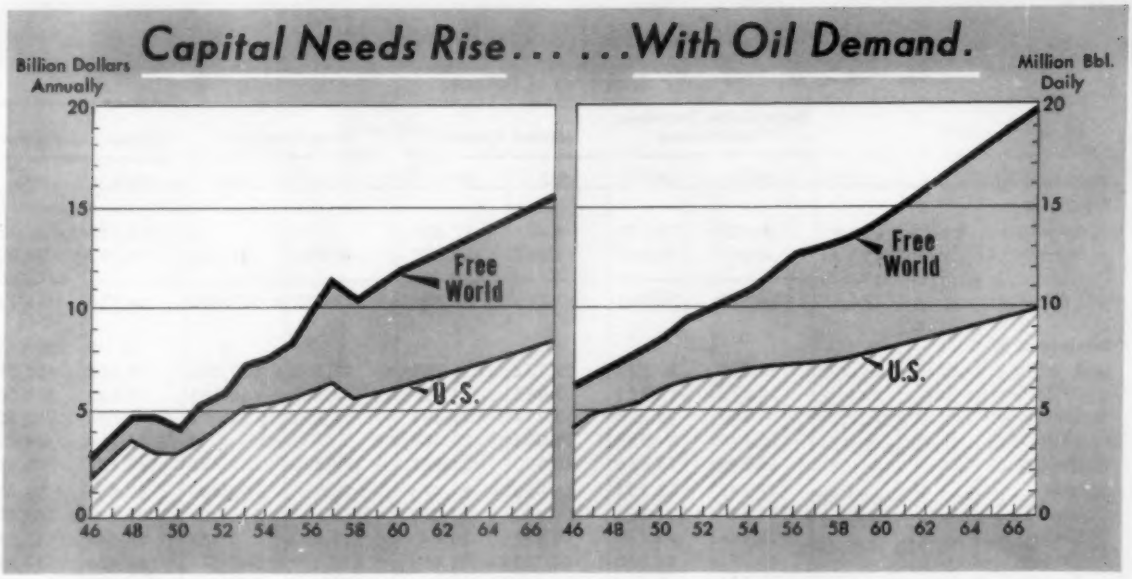
# Oldtimer Is Operating Alone Offshore

MAGNOLIA Petroleum Co., though the first company to drill out of sight of land in the Gulf of Mexico, just recently produced its first wholly owned offshore oil and gas.

The company is producing about 400 bbl. of oil and roughly 3,000,000 cu. ft. of gas daily from two oil and two gas wells in Block 46, Main Pass field, 64 miles southeast of New Orleans.

Magnolia was one of the first producers offshore but early in the game sold part interests in its acreage holdings to Continental Oil Co. and Newmont Oil Corp. These joint operations continue.

Block 46 is Magnolia's first go-it-alone success. The field was discovered in 1946, but production was delayed until last month. Six wells have been completed so far.




# Oil's Financing Pattern Is Changing

- Company earnings can no longer cover the costs of expansions required by an ever-increasing demand. Some companies have turned to stock issues while others still prefer increasing their long-term debt.

- A definite trend has not been established, but one thing is certain—oil will need outside cash in the next few years to pay all the bills.

OIL MEN are borrowing money at a record rate. Signs are this trend will continue at least through the next 5 years.

Financial records show the free-world oil industry has attracted more than one billion dollars in new capital during each of the last 2 years.

So far this year, indications are that the industry will acquire one and one-half billion dollars in new capital.

Previous high-water marks in oil-industry capital financing were in 1948 and 1952 when new public flotations averaged about $750 million.

How much new capital the industry will need during the next decade can only be guessed. But this is the prospect:

**...Capital expenditures** are expected to run a billion dollars per month in the next 5 years and 1¼ billion dollars monthly in the succeeding 5 years.

**...Cash to pay these bills** will come from internal financing, such as retained profits, depreciation, depletion, amortization, and from outside financing. With the outlook none too bright for any great growth in profits, it's a good bet the oil industry will have to depend more and more on outside financing to meet its expansion needs.

**The record . . .** In the past when oil companies needed outside cash, they have preferred long-term debt rather than equity issues.

In practically every year from 1942 through 1957, more capital was obtained from new debentures than from the sale of stock.

There have been some notable exceptions to this rule in the last year or so. Three major companies have raised more than $800 million from stock sales within a short period of time. These were Royal Dutch-Shell Group, $353 million; Standard Oil Co. (N. J.), $281 million; and Socony Mobil Oil Co., $193 million. It was the first time that Royal Dutch-Shell, for instance, had gone to the money market in nearly a decade.

Meanwhile, three other majors have had debenture offerings this year. Sandard Oil Co. (Ind.) floated a $200-million issue; The Texas Co. and Standard Oil Co. of California, $150 million each. Two smaller issues were floated by Richfield Oil Corp. for $50 million and Pacific Petroleums for $30 million.

The Texas Co. acted early in the year when rates were down. And as one New York financial expert put it, "Texaco came up smelling like a rose." Its rate of 3⅜% compares with 4⅜% for the California issue and 4½% on Indiana's debentures. Both California and Indiana didn't go to the money well until September.

The new debentures of all three will add considerably to their long-term debt. But compared to other companies and to other industries the ratio still is low.

Texaco's ratio of invested capital to long-term debt will go from something like 6.7:1 to 5:1; California from 23.6:1 to 9:1; and Indiana from about 10.3:1 to 6.3:1.

But this also will be a big year for additions to equity capital. Several companies have moved to increase holdings in subsidiaries or acquire other companies in stock trades.

Biggest individual deal was Jersey's acquisition of Humble stock. Jersey increased its holdings in its major domestic subsidiary to more than 98% at a cost of about $450 million in Jersey stock. Jersey also increased

## Where Oil Gets Its Dollars for Growth

(Thousands of Dollars)

| | Depreciation, Depletion, Amortization | | Retained Earnings | | Long-Term Debt | | Capital Expenditures | |
|---|---|---|---|---|---|---|---|---|
| | 1952 | 1957 | 1952 | 1957 | 1952 | 1957 | 1952 | 1957 |
| **Producers** | | | | | | | | |
| Amerada | 8,948 | 13,121 | 6,432 | 17,327 | 0 | 0 | 24,832 | 51,025 |
| Superior | 5,667 | 10,247 | 1,269 | 18,877 | 29,638 | 91,526 | 19,902 | 34,902 |
| Total | 14,615 | 23,368 | 7,701 | 36,204 | 29,638 | 91,526 | 44,734 | 85,927 |
| **Integrated (U. S.)** | | | | | | | | |
| Atlantic | 35,939 | 51,629 | 22,131 | 16,385 | 31,368 | 182,000 | 72,880 | 120,294 |
| Cities Service | 56,879 | 80,665 | 31,285 | 34,429 | 419,286 | 480,186 | 89,042 | 179,300 |
| Continental | 18,867 | 35,776 | 13,747 | 15,404 | 151,752 | 32,091 | 90,748 | 110,623 |
| Ohio Oil | 16,130 | 24,529 | 19,264 | 20,487 | 0 | 0 | 46,224 | 64,799 |
| Phillips | 48,746 | 78,915 | 40,500 | 37,817 | 274,490 | 332,733 | 190,402 | 216,417 |
| Pure | 21,248 | 28,122 | 15,053 | 21,774 | 28,353 | 90,485 | 39,516 | 57,407 |
| Shell | 138,562 | 227,803 | 50,461 | 74,512 | 149,307 | 166,087 | 206,141 | 265,635 |
| Skelly | 22,446 | 33,576 | 18,892 | 26,442 | 11,862 | 5,657 | 37,543 | 55,647 |
| Sinclair | 46,291 | 84,065 | 54,732 | 33,403 | 350,119 | 340,561 | 181,134 | 157,463 |
| Standard of Indiana | 85,735 | 163,702 | 73,110 | 95,206 | 355,260 | 271,639 | 204,293 | 340,274 |
| Standard of Ohio | 26,360 | 31,417 | 7,211 | 11,082 | 36,928 | 63,003 | 29,701 | 69,885 |
| Sun | 28,167 | 53,717 | 36,032 | 36,740 | 10,350 | 47,330 | 74,600 | 92,800 |
| Tidewater | 29,125 | 62,916 | 16,404 | 31,942 | 0 | 245,573 | 40,514 | 140,231 |
| Union | 41,815 | 64,911 | 16,147 | 19,720 | 118,203 | 187,050 | 71,383 | 91,346 |
| Total | 616,310 | 1,021,743 | 414,969 | 475,343 | 1,937,278 | 2,444,395 | 1,374,121 | 1,962,121 |
| **International (U. S.)** | | | | | | | | |
| Gulf | 128,995 | 252,265 | 96,439 | 280,461 | 181,730 | 299,509 | 192,688 | 546,453 |
| Socony | 129,790 | 221,782 | 105,898 | 102,046 | 196,909 | 181,965 | 264,099 | 348,307 |
| Standard of California | 98,944 | 95,284 | 88,011 | 168,108 | 85,167 | 82,283 | 173,135 | 303,823 |
| Standard of New Jersey | 227,579 | 449,036 | 263,099 | 363,097 | 459,445 | 642,604 | 565,489 | 1,130,506 |
| Texas | 169,022 | 216,177 | 98,751 | 203,397 | 226,289 | 356,739 | 224,766 | 379,052 |
| Total | 754,330 | 1,234,544 | 652,198 | 1,117,109 | 1,149,540 | 1,563,100 | 1,420,177 | 2,708,141 |
| **GRAND TOTAL** | **1,385,255** | **2,289,655** | **1,174,868** | **1,628,656** | **3,116,456** | **4,099,021** | **2,839,032** | **4,756,189** |

its holdings in International Petroleum. In other deals, Texaco acquired Seaboard; Getty extended its Mission holdings; and Sinclair has offered to acquire Texas Pacific Coal & Oil.

**Future needs . . .** Oil industry's capital expenditures in the past have closely paralleled demand for its major products.

So with economists predicting increases in demand for petroleum products in the years ahead, financiers are counting on a parallel increase in the oil's need for money.

Demand in this country is expected to increase at the rate of 3% per year. Free-world demand outside the U.S. by conservative estimates is expected to grow 6% yearly through the next decade. On this basis, the industry will spend $60 billion on capital outlays in each of the next 5 years and $75 billion in the succeeding 5.

Actual capital layouts may vary from year to year, but the average expenditures will follow a smooth upward curve paralleling demand.

The year-to-year fluctuations stem from the very nature of the oil business. Oil companies can't spend several hundred million each year on acquiring Venezuelan concessions, for instance. So they jump into the play in a single year with funds derived from surplus or borrowings on future income. Thus the burden of the heavy spending is spread over several years.

Profits also dictate year-to-year expansion. In a year like 1958, companies tend to rely on their excess capacity or defer new construction as long as profits are low. This means greater expenditures when demand increases and forces new building.

This upward trend in capital expenditures is illustrated by the 5-year experience of 21 companies. They spent $2,839 million in 1952 and $4,756 million in 1957. The increase in 5 years is almost $2,000 million or slightly less than 70%.

Increased capital spending isn't the only trend in these years. Sources of the money also have seen some changes. For the 21 companies studied, funds provided in 1952 through depletion, depreciation, and amortization totaled 18% more than funds from retained earnings. By 1957, however, money generated from depletion, depreciation, and amortization was 45% greater than retained earnings.

**Role of profits . . .** What is behind this switch in sources of internally generated funds?

Only part of the change can be attributed to the accelerated writeoffs for certain facilities under the national defense program. These writeoffs have been allowed almost exclusively for refining and transportation facilities.

Firms obtaining the fast writeoff certificates naturally would show a

## Oil Profits: A Percentage Slide

(Thousands of Dollars)

| | Gross Income | | | Net Income | | | Net as % of Gross | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1947 | 1952 | 1957 | 1947 | 1952 | 1957 | 1947 | 1952 | 1957 |
| **Producers** | | | | | | | | | |
| Amerada | 47,225 | 75,107 | 116,385 | 14,920 | 15,896 | 29,949 | 31.59 | 21.16 | 25.73 |
| Superior | 35,651 | 67,410 | 108,277 | 4,867 | 11,900 | 18,877 | 13.65 | 17.65 | 17.43 |
| Total | 82,876 | 142,517 | 224,662 | 19,787 | 27,796 | 48,826 | 23.88 | 19.50 | 21.73 |
| **Integrated (U. S.)** | | | | | | | | | |
| Atlantic | 320,145 | 602,805 | 565,946 | 15,898 | 40,477 | 35,670 | 4.97 | 6.71 | 6.30 |
| Cities Service | 468,926 | 892,198 | 1,046,360 | 40,465 | 50,721 | 59,179 | 8.63 | 5.68 | 5.66 |
| Continental | 228,731 | 397,185 | 608,891 | 31,357 | 38,088 | 46,724 | 13.71 | 9.59 | 7.67 |
| Ohio | 130,772 | 223,241 | 288,708 | 29,161 | 39,354 | 41,490 | 22.30 | 17.63 | 14.37 |
| Phillips | 298,310 | 720,528 | 1,131,794 | 40,894 | 75,284 | 96,209 | 13.71 | 10.45 | 8.50 |
| Pure | 244,412 | 340,106 | 508,775 | 21,197 | 27,304 | 35,524 | 8.67 | 8.03 | 6.98 |
| Shell | 628,105 | 1,142,632 | 1,764,602 | 59,875 | 90,873 | 135,085 | 9.53 | 7.95 | 7.66 |
| Skelly | 121,324 | 206,426 | 263,182 | 21,091 | 28,033 | 36,785 | 17.38 | 13.58 | 13.98 |
| Sinclair | 488,388 | 855,556 | 1,251,069 | 52,432 | 86,475 | 79,308 | 10.74 | 10.11 | 6.34 |
| Standard of Indiana | 910,746 | 1,592,120 | 2,010,115 | 94,880 | 119,981 | 151,509 | 10.42 | 7.54 | 7.54 |
| Standard of Ohio | 195,645 | 301,573 | 419,046 | 16,391 | 17,697 | 23,920 | 8.38 | 5.87 | 5.71 |
| Sun | 356,841 | 617,390 | 771,620 | 24,340 | 43,013 | 47,492 | 6.82 | 6.97 | 6.15 |
| Tidewater | 303,253 | 429,037 | 596,263 | 30,176 | 31,117 | 34,937 | 9.95 | 7.25 | 5.86 |
| Union | 171,378 | 285,541 | 432,655 | 18,911 | 27,580 | 28,235 | 11.03 | 9.66 | 6.53 |
| Total | 4,869,976 | 8,606,338 | 11,659,026 | 497,068 | 715,997 | 842,067 | 10.21 | 8.32 | 7.22 |
| **International (U. S.)** | | | | | | | | | |
| Gulf | 797,211 | 1,528,806 | 2,730,085 | 95,540 | 141,820 | 354,284 | 11.98 | 9.28 | 12.98 |
| Socony | 1,028,634 | 1,996,621 | 2,976,104 | 97,709 | 171,092 | 220,433 | 9.50 | 8.57 | 7.41 |
| Standard of California | 530,132 | 1,015,309 | 1,650,823 | 107,269 | 174,030 | 288,230 | 20.23 | 17.31 | 17.46 |
| Standard of New Jersey | 2,354,917 | 4,050,819 | 7,830,250 | 268,627 | 519,981 | 805,177 | 11.41 | 12.84 | 10.28 |
| Texas | 819,211 | 1,510,073 | 2,344,177 | 106,313 | 181,242 | 332,304 | 12.98 | 12.00 | 14.18 |
| Total | 5,530,105 | 10,101,628 | 17,531,439 | 675,458 | 1,188,165 | 2,000,428 | 12.21 | 11.76 | 11.41 |
| **GRAND TOTAL** | **10,482,957** | **18,850,483** | **29,415,127** | **1,192,313** | **1,931,958** | **2,891,321** | **11.37** | **10.25** | **9.83** |

larger proportion of capital investment recovered and available for new spending. But facilities covered by quick amortization represent less than one-fourth of oil's typical annual capital expenditures. This means accelerated writeoffs have accounted for only a small part of the trend.

The conclusion is that oil-company profits have not increased sufficiently in the last few years to carry their proportionate share of providing funds for expansion.

The experience of the 21 oil companies again illustrates this trend. These firms did $10,483 million worth of business in 1947 and $29,415 million in 1957. This is an increase of almost $19,000 million or more than 180%.

During that time, net profits increased from $1,192 million to $2,891 million. This is an increase of almost $1,700 million. So while gross business increased 180%, the net profit went up about 140%.

Expressed another way, this trend is pinpointed even clearer. In 1947 the net profit of 21 oil firms represented 11.37% of total business. By 1952, it had dropped to 10.25% and by 1957 to 9.83%.

This shrinking profit margin is a cause of some concern. Here's why. Money managers for oil companies in the past have offset lagging profit margins with funds derived from other internal sources. For producers, it has been depletion allowance, for refiners some quick writeoffs, for others charging drilling and exploration investment to current expenses.

But the need for capital has grown so large that these traditional sources no longer will pay the bills. That explains why the oil industry recently has sought outside capital. There is every reason to believe this trend also will grow.

**Sound position . . .** Does this borrowing mean the industry is going broke? Will it be able to pay its debt and still return dividends to stockholders?

Financial experts say positively that oil can easily meet its financial obligations. They point out that the petroleum industry is, in fact, in a better debt position than most other American industries.

They outline these factors as contributing to oil's sound position:

. . . **The depletion** allowance.

. . . **Favorable** long-term debt picture.

. . . **Production-**payment deals.

. . . **Lease-back** device.

Both the production payment and the lease-back devices accomplish the same goal, acquire property without a large outlay of capital.

The production-payment device allows companies to purchase ultimate reserves and pay them out of current production from the property. The practice has a tax advantage as well as a financial one.

By the lease-back device, a second

# Texas pipeline is connected to battleship

HOUSTON Natural Gas Co. can claim the distinction of being the only gas line hooked up to a battleship.

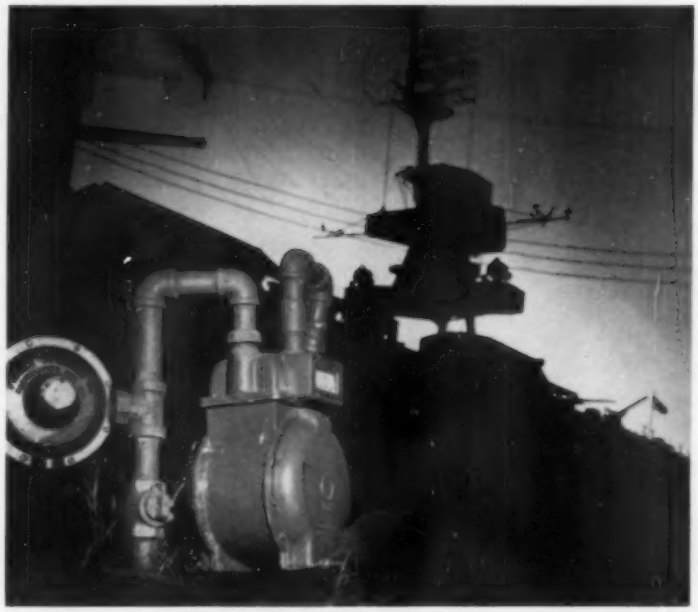
The company serves the battleship Texas, now a state monument standing guard on the San Jacinto Battleground near Houston. Gas is burned in furnaces which heat custodian's quarters.

If any pipeline were connected to a battleship, it would naturally be a Texas pipeline. To our knowledge, this installation is unique in the industry.

This may not sound very earth-shaking to you. Actually, it isn't very important to anybody, except, perhaps, Houston Natural and the man who lives aboard the Texas. It's just one of the interesting things you run across in researching for Petroleum Panorama, the hundred-year history of the oil business which will be published by The Oil and Gas Journal next year. It didn't seem to fit anywhere—there was no chapter on pipelines connected to battleships—but we did want to pass it on to our readers.

We do guarantee that you'll find every other phase of petroleum transportation chronicled in Petroleum Panorama.

The graceful sailing ships which first carried oil across the seas, the



precarious barge, the wooden tank mounted on a flat car, the tong gangs who cracked teamster heads as part of their pipe-laying job, the evolution of the science of pipeline hydraulics, the impact of the engineer, the development of prime movers and pumps and compressors, the giant machines which build today's lines and the instruments and men who run them . . . all this is told as only a staff with a heritage of over 50 years of petroleum transportation reporting can tell it.

company builds a facility and leases it at an annual rental to the oil firm. This is common practice for service stations, tankers, and real estate. The oil company gets use of the facility and pays for it over a period of years without a heavy initial outlay of cash.

Many companies regard these rentals as an operating expense, and they are budgeted as such. However, they are long-term obligations, and if considered as debt, they can change the long-term debt picture of a company considerably.

Not all companies segregate their annual rentals in reports to stockholders. Of the dozen or so that do, the annual rentals range from a low of $4.5 million to almost $115 million for the largest firm.

If these rentals were capitalized at 8%, it would add $56 million to the long-term obligations of the smaller company and $1,437 million to those of the larger. It would increase the smaller firm's long-term debt from $182 million to $238 million and the larger firm's from $642 to $2,079 million. Capitalizing these long-term obligations at 8% seems reasonable since an annual rental payment of 7.7% is required to retire an obligation in 20 years at a ½% interest rate.

**Debt picture . . .** The oil industry's long-term debt position actually is stronger than a decade ago.

Thirteen of the 14 integrated companies in the accompanying table had a combined long-term debt of $1,177 million in 1947 and $2,412 in 1957. The international companies listed increased their debt from $752 million in 1947 to $1,563 million in 1957. The two groups together increased debt from $1,929 million in 1947 to $3,975 in 1957. That's an increase of about 100%.

During the same time, gross volume of business increased 180% and net income 140%. In relation to volume of business and profit, stated long-term debt of the companies dropped in the 10-year period.

Here's how oil's 100% debt increase in 10 years compares with that of some other industries: Three automobile companies, 574%, eight steel companies, 100%; three electrical-equipment companies, 160%; seven chemical companies, 217%; five rubber companies, 100%; and four metals companies, 485%.

All these factors explain why the financial experts report the oil industry will have no trouble getting new capital if indications prove true and more oil firms start making trips to the money market.

## New Indian Lease Rules Set

INTERIOR Sec. Fred A. Seaton has approved new federal rules to encourage farmouts on Indian leases.

The new regulations permit overriding royalties or payments out of production on oil and gas leases on Indian lands. They are similar to proposed changes announced last May. However, the rules as adopted eliminate the earlier proposal that farmouts on Indian lands must be approved in advance by the Secretary of the Interior.

While releasing to a third party does not increase the landowner's royalty, Interior pointed out, "it may promote greater production" under a lease.

# Products Line Almost Ready

**. . . to serve Chicago. Wabash's line will funnel products from Oklahoma and Illinois into growing Midwest market.**

COMPLETION of Wabash Pipe Line's Wood River-Chicago 12-in. products line this month will give shippers economical transportation to the Midwest's biggest consuming area.

Construction of the 350-mile common carrier is a strategic marketing move by Ohio Oil Co., which owns 75% of Wabash. With a terminal at Griffith, Ind., near Chicago, Ohio has "a beachhead" on Lake Michigan. The 12-in. leg from Ohio's Robinson, Ill., refinery, joining the main line at Champaign, provides an improved link to central and northern Illinois markets.

Wabash will have delivery facilities at Champaign and Griffith and also will deliver to privately-owned terminals at these locations. The line will deliver to water loading facilities for shipment by canal to Chicago and by lake vessels to other Great Lakes ports. Connections are possible to other products lines in the East Chicago area.

**Oklahoma link . . .** Wabash will receive products at Wood River from Cherokee Pipe Line Co., owned by Continental Oil Co. (25% owner of Wabash) and Cities Service Pipe Line Co., and from refineries in the Wood River-East St. Louis, Ill., area.

Cherokee is connected to Continental and Cities Service refineries at Ponca City, Okla., and to The Texas Co. and D-X Sunray Oil Co. refineries at Tulsa. Cherokee recently completed a 12-in. line from Ponca City to Glenn Pool, near Tulsa, and converted a 10-in. line from Glenn Pool to Wood River to products service (OGJ, July 21, p. 52).

This gives Cherokee two 10-in. products lines from Glenn Pool to Wood River, with capacity of 60,000 bbl. daily and provision for expansion to 90,000 bbl. daily.

Wabash, with outdoor electric pump stations at Wood River, Robinson, and Champaign, will have initial capacity of 60,000 bbl. daily and ultimate capacity of 100,000 bbl. daily. The system will be operated remotely from Findlay, Ohio, dispatching center of Ohio Oil, over a microwave network.

## PG&E Plans Gas Storage

TWO UNDERGROUND gas-storage projects are planned by Pacific Gas & Electric Co. to cushion peak-demand days in the San Francisco bay region.

Main project will be in the McDonald Island dry gas field, about 50 miles east of San Francisco. The two-well, 160-acre, Pleasant Creek field, near Winters, 50 miles northeast of San Francisco, also will be converted to storage.

Natural Gas Corp., a PG&E subsidiary, recently acquired the field from Standard Oil Co. of California. In exchange for McDonald Island wells, gathering lines and equipment, Natural Gas transferred substantially all of its mineral holdings in Rio Vista field to Standard.

## —— *Industry* briefs

**Efforts by International Union** of Operating Engineers (AFL-CIO) to unionize Western Co., oil well servicing firm, went down to defeat. Employes of the firm, which has general offices at Midland, Tex., voted 224 to 45 against union representation.

**Work has started** to nearly double the capacity of a 176,000-bbl. underground-storage cavity for light hydrocarbons in Texaco's Sour Lake, Tex., field. The expansion project will be completed in about 4 months. Expanded capacity will be 326,000 bbl.

**Purchase of all producing** leases in the West Konawa field of Seminole County, Oklahoma, has been made by Blackwell Oil & Gas for water-flooding purposes. The properties include seven leases, covering 200 acres, with 10 producing wells. Blackwell hopes to get approval of unitization and water-flooding program early next year.

**Pecos Exploration** Co., Dallas, has acquired leases on 160,000 acres in Johnson and Pope counties, Arkansas, and will launch an intensive gas exploration program of the spread in the near future. A company spokesman said Pecos had conducted a geological study of the area for the past 4 years. It is the firm's first venture outside Texas. Pecos has opened a division office in Tulsa under Harry L. Warlick, Jr., for the program.

**A big water flood** in Kansas and newly acquired property in East Texas will increase reserves of Livingston Oil Co., Tulsa. The company has acquired major interest in 29 wells in the Kilgore area from American Liberty Oil Co. The deal involves about 900,000 bbl. of reserves. Recovery of more than 1,500,000 bbl. of new oil is expected from a proposed 4,000-acre flood in Huffstutter field, Phillips County, northern Kansas. Pilot flood will start in the next 6 weeks.

**Merger of Southwest** Oil Corp. with Mid-Plains Corp. of Blackwell, Okla., has been approved by Southwest directors. The agreement also is subject to approval by Southwest stockholders. Under the merger, Mid-Plains will be liquidated and most of its personnel will be absorbed into Southwest. Mid-Plains' properties include 15 producing wells in Kay County, Oklahoma. Reserves were estimated at 2,174,000 bbl.

# New Gas Service Offered

## . . . by Texas Eastern to 15 eastern utilities. Plan will offer winter peaking gas on a firm basis for 5 months.

A SIGNIFICANT new type of winter peaking gas service by Texas Eastern Transmission Corp. has received temporary approval from the Federal Power Commission.

The service was approved along with a $35-million expansion of Texas Eastern and its subsidiary, Texas Eastern Penn-Jersey Transmission Corp.

Peaking service before has been on a short-term basis only. Texas Eastern's new agreement, however, offers "extra" gas on a regular basis throughout the heating season. It involves storage of large quantities of gas in summer for winter delivery.

**Winter peaking plan . . .** The FPC authorized 150,000,000 cu. ft. per day in winter peaking service to 15 customers between November 16 and April 15.

This special service over the 5-month period when space-heating demand is heaviest will build to 333,000,000 cu. ft. daily in the third year. At the end of the development period, volume will amount to 20 billion cubic feet per year.

Price for winter service gas is 66.3 cents per M.c.f. if gas is taken in full quantities. This is enough below the price for short-term winter peaking gas to encourage gas utilities to take large volumes and build a larger firm space-heating load more rapidly than otherwise.

The service also increases Texas Eastern's volume and revenue by a considerable sum. It also will permit more efficient operation of the total pipeline system by balancing year-round load and will stabilize the take from gas wells, reducing penalties under take-or-pay contracts.

Such unique service on a regular basis will be possible because of Texas Eastern's excellent underground-storage facilities in Pennsylvania. The company's pipelines from the Gulf Coast and Mexico will be able to operate at near full capacity in the summer, pumping gas into storage for use in the winter.

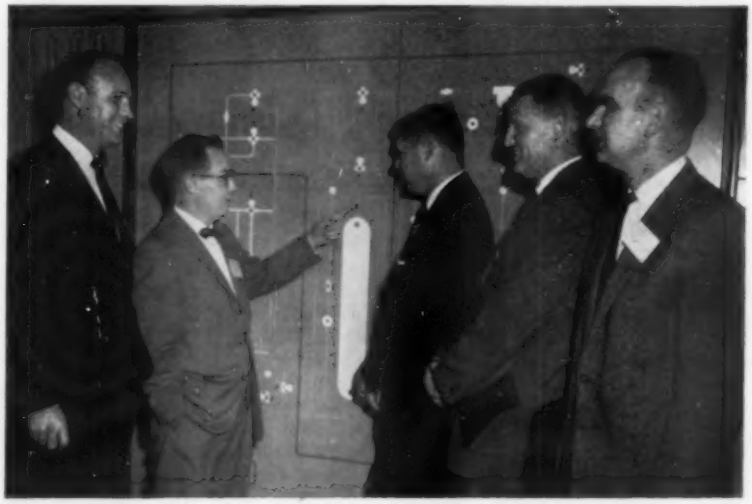
**New facilities . . .** The new projects, together with a $5,890,000 construction program authorized in November 1957, will permit Texas Eastern to increase delivery capacity of the entire system by 101,660,000 cu. ft. per day.

New construction planned by Texas Eastern includes 28.8 miles of 30-in. pipeline loops, 125,270 hp. in new and existing compressor stations, and five new meter stations. Penn-Jersey proposed to construct 12.5 miles of 30-in. loops and to add 57,600 hp. in new and existing stations.

To provide capacity for increased demand expected in the next 3 years, Texas Eastern will spend $46.7 million to build more than 200 miles of 20 to 36-in. loops and add 3,300 hp. in compression.

Texas Eastern's proposal to attach a new gas supply in Rayne field in Louisiana was not covered by the order. This major reserve in Acadia Parish is to supply 100,000,000 cu. ft. daily. Producers are Continental Oil Co. and associated companies and individuals, M. H. Marr, Dallas, Sun Oil Co., and General Crude Oil Co., Houston.

An FPC examiner last April approved certificates for the producers at the record price of 23.9 cents an M.c.f., including 1.3 cents of tax reimbursement. Sun later withdrew when a permanent certificate was held up. Since that time parties have been seeking a sales formula which will be acceptable to all.



SCIENTISTS* take a look at control board of computer-controlled unit.

# Automatic Plant Is Developed

## . . . by Esso Research and Consolidated Electrodynamics to be put to work on catalyst research at Bayway refinery.

THE WORLD'S FIRST fully automatic computer-controlled pilot plant for chemical and petrochemical research will be installed at Esso Standard Oil Co.'s Bayway refinery, Linden, N. J.

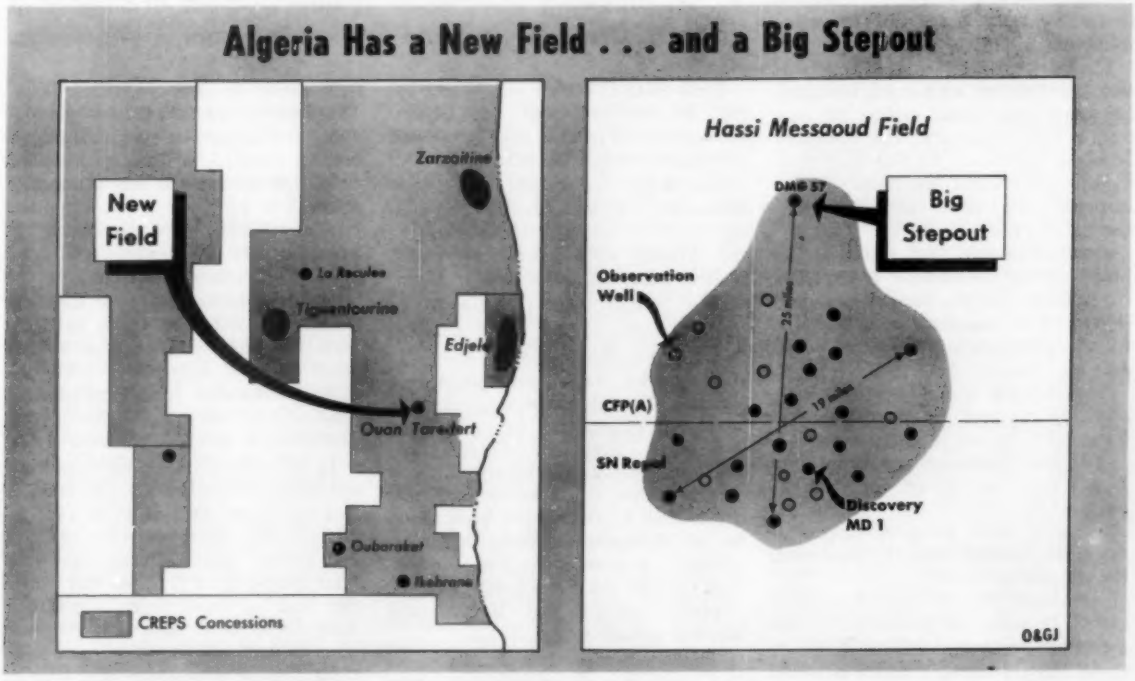
The pilot plant was built by Consolidated Electrodynamics Corp., Pasedena, Calif., in cooperation with Esso Research & Engineering Co. It was demonstrated recently in a 2-day meeting of researchers from many oil and chemical companies at Monrovia, Calif.

C. Kenneth Hines, CEC systems division manager, said the plant automatically measures, records, and controls temperatures, pressures, and steam compositions. A computor, capable of making five control decisions a second, stands watchdog on the plant operation.

Use of the plant is expected to result in saving of both nontechnical and scientific manpower, completion of test programs in half the time now required, and development of an entirely new method of pilot-plant experimentation, William Priestley of Esso's process research division, said.

First "assignment" of the plant at Esso wil be to seek better catalysts for catalytic reforming.

*Left to right: C. Kenneth Hines, CEC systems division; William Priestley, Esso process-research division; Dr. Waldo Rall, U. S. Steel Corp.; C. P. Brewer, Shell Development Co.; R. D. Dean, Union Carbide Chemicals Co.




# French Firms Score Twice in Sahara

**• Algerian oil picture is looking brighter. New developments include 12-mile extension of Hassi Messaoud field and apparent discovery of the fourth field in the Edjele area.**

AFTER Gen. Charles de Gaulle, France's strong man, made his recent trip to Algeria and the Sahara, the French press and radio flowered with a new series of exaggerated and glowing reports of size and extent of the Sahara's oil.

Oil men with the French companies protested. Reality is nice enough, they reason. Why exaggerate?

Last week, it appeared there is more to boast about than ever before.

In two widely separated regions of the Sahara, French oil companies added new wells. One was a dramatic 12-mile stepout to the already vast, deep Hassi Messaoud field. The other is apparently a new field discovery in the southeast, producing oil from the Ordovician which until now has only given up gas in that region of the Sahara.

**Hassi Messaoud . . .** Easily the more dramatic of the two new wells is OMG-27, an exploratory test 12 miles to the north of established production in the field.

Few details of the well's potential are available. The French so far have not released any test figures. The well was drilled to a total depth of 11,653 ft. after passing what Cie. Francaise Petrole (Algerie) calls a "thick" oil zone. Unofficial reports last week were that the pay is about 100 ft. thick. This is considerably less than the 400 to 500 ft. of pay encountered by the wells to the south.

Thick or thin, the newly found pay zone has apparently extended the limits of the field far to the north. On a north-south axis, the new well is 25 miles from MD 7, the southernmost well in the big field. The previously completed 18 producers in the field stretch for 19 miles from southwest to northeast.

CFP(A) is drilling another six wells in the northern half of the field which it is developing. The company is setting 7-in. casing to 10,898 ft. in one of them and to 10,860 ft. in another preparing to complete both. A third well has entered the Cambrian pay.

In the southern part of the field, being developed by SN Repal, five development wells are under way. Four of these have already drilled well into the pay at depths from 10,892 ft. to 11,369 ft.

The entire field has never been really tested under full production because it has only a 6-in. pipeline outlet north to the railhead at Touggourt where the crude is transshipped to the Mediterranean by rail. Even so, CFP(A) and SN Repal are moving about 10,000 bbl. daily from only seven wells—all the pipeline can take.

As soon as the 24-in. pipeline, now under construction, is finished, the companies will have a chance to pull their wells and study the tight reservoir.

**New Edjele area discovery . . .** More than 330 miles southeast of Hassi

Messaoud, the French-Shell company, CREPS, has added what is probably its fourth productive field to a growing string of discoveries.

The newest good-looking find is Ouan Taredert 1, about 19 miles southwest of Edjele field.

Cie. de Recherches et d'Exploitation des Petroles au Sahara was cautious last week about calling the new well a field discovery. The company is more impressed by the fact they have a commercial test from the Ordovician—the first in the southeastern Sahara to yield oil.

Ouan Taredert first tested 2,512 M.c.f. of wet gas an hour from 4,741 ft. Drilled 200 ft. deeper, the well flowed 37 bbl. an hour of light crude with a bottom-hole pressure of 2,290 psi.

The well was drilled to a total depth of 5,434 ft., and 4½-in. casing was set at 5,035 ft. for production tests.

The new Ordovician producing zone is not only the newest for CREPS, but also the deepest. All three of the company's fields being developed to the north produce from the Devonian, the deepest at 4,500 ft.

At Edjele the company has completed 39 wells, all productive in the Devonian at from 1,600 to 2,700 ft.

At Tiguentourine, CREPS is in the process of completing its tenth producer in a Devonian pay found at about 2,800 ft.

Zarzaitine, the newest of the developing fields and probably the best of the three, has five producers and CREPS believes it has established the eastern flank of the structure with its last well. Two rigs are running in this field.

None of the three are producing because there is no pipeline outlet. Plans are being pushed to build a 24-in. line northward along the Sahara-Libyan frontier to the southern tip of Tunisia and then north through Tunisia to the Mediterranean near Gabes.

## Lake Crude Line Planned

SUPERIOR OIL CO. is planning a 16 and 24-in. crude line from its Lake Maracaibo production to shore.

Engineering studies will be completed within a month, and construction will begin shortly thereafter.

Superior, a highly successful newcomer to the Maracaibo oil play, is now handling its 65,000-bbl. per day production by tanker.

Pipe Line Technologists, C.A., Maracaibo - based subsidiary of Pipe Line Technologists, Inc., Houston, is doing the design work.

Superior said the line will have an initial capacity of 100,000 bbl. daily and ultimate capacity of 200,000 bbl.

# Parentis Outlook Rosy

**. . . following completion of development drilling. It is the field which triggered France's oil hunt 4 years ago.**

THE FIELD which put France in the oil business and gave every Frenchman oil fever is fully developed and faces a long productive life.

Esso-Rep, controlled by Jersey Standard, is in the process of completing the final well drilled in Parentis, the March 1954 discovery which made France oil conscious.

The 29-well field is expected to produce from 23,000 to 24,000 bbl. daily for the next 55 years.

With the full development of Parentis, France passes one oil milestone and approaches several others.

Parentis electrified France four years ago and started its oil search in earnest. Since that time at least five more small oil fields have been found in a European nation that was virtually without oil. The Parentis find spurred the French effort in the Algerian Sahara that has showed marked success (see p. 53).

The latest success in France came last week just about the same time the drilling at Parentis was being completed. In the Paris basin, a third apparent new field was unveiled.

**Parentis . . .** When Esso Standard, S.A.F., brought in its third test at Parentis, 70 miles southwest of Bordeaux, in 1954 as a 3,000-bbl. well, Parentis became a magic word in France.

Overnight, the single well increased France's oil production by 50%.

Since that time a new company, Esso-Rep (63.2% Jersey, 18.3% Gulf Oil, and the remainder French capital) has been steadily drilling up the structure in two horizons, one deep and the other shallow. The field extends into the waters of Lake Biscarosse.

The primary pay horizon of the field is a dolomitic limestone found below 7,500 ft. An upper fractured limestone is producing several wells on pump at a shallower depth.

Parentis has an active water drive, and almost from the start, Jersey reservoir engineers had trouble finding the key to the most efficient producing methods. Wells were completed at tests of more than 3,000 bbl. daily and then rapidly dropped off because of water encroachment.

Today, the company is proud of the engineering job it has done. It is maintaining the pressure with a water-injection program that will sustain the field easily. It is not a water flood. The fluid is injected below the oil-water contact and is supplementing a natural water drive that is not good enough to sustain the best productive results.

The company has a number of wells in the field that are dual-injection producing wells.

The productive history of the field pretty well tells the story. In 1954 when Parentis was discovered, France could boast of only about 7,000-bbl. daily production from Pechelbronn field and several small fields in that northeastern area of France.

In 1954, Parentis produced an average of 2,730 bbl. daily; in 1955 it rose to 11,348 bbl. daily; in 1956 to 20,226 bbl. daily; and in 1957 to 23,755 bbl. daily. During the post-Suez period in 1957, Esso-Rep pulled the field at more than 25,000 bbl. daily for a time. But now they are able to settle down to a more efficient rate of production that will be safer for the reservoir.

A new, modern 35,000-bbl. refinery at Bec d'Ambes near Bordeaux, built to process the Aquitaine crude, is expected to go on stream in April.

In addition to Parentis, Esso-Rep has two more promising Aquitaine fields and is continuing a wildcatting program with four active rigs.

At Lugos, six wells are now producing an average of 680 bbl. daily and at Mothes, another three wells account for 1,172 bbl. daily.

**The Paris basin . . .** The third promising find in the Paris basin was made public last week.

France-Outre-Mer de Prospections et Exploitations Petrolieres (FROPEX) said that its third and fourth wells in the Chateaurenard region southwest of Paris have had promising tests.

Chateaurenard No. 3 found two oil horizons. The first tested about 10 bbl. an hour from 1,838 ft. The second horizon, found at 1,865 ft., tested at the rate of 7½ bbl. an hour. At Chateaurenard No. 4 located 2,130 ft. to the southwest of the No. 2 well, a test recovered 10 bbl. of oil on a 50-minute test of an interval found at 1,870 ft.

Owner of the operation is divided between American Overseas Petroleum (France), a Caltex affiliate, and Cie. Exploration Petroles (CEP), controlled by French capital.

# New Refineries Are Planned

**. . . for Tokyo Bay. One project includes 35,000-bbl. unit. A 20,000-bbl. plant is being considered for the other.**

TWO JAPANESE oil companies have teamed up for a refinery-building project which will get under way next year.

Toa Nenryo, 50% owned by Standard Vacuum, and Nippon Tyomo Sengu, which bunkers fishing boats and sells fuel oil, have formed a new company, Nichimo Oil Refining Co.

The new firm will start work next year on a refinery site located on reclaimed land at Kawasaki on Tokyo Bay. The capacity will depend on the marketing outlook, but a 20,000-bbl. plant is being considered. Whether downstream-processing facilities are built will hinge on the outcome of a campaign by the coal industry to limit fuel oil uses.

Toa Nenryo has also joined with another Japanese marketing company, General Bussan, in a second refinery project at Kawasaki. The new company, General Sekiyu, will start work on a 35,000-bbl. plant in April.

Construction of the new plant will start in April. First stage, slated for completion by December 1960, will include a 35,000-bbl. daily crude unit and product treating units. The second stage, including a 5,000-bbl. Powerformer, a 6,000-bbl. Hydroformer, and an LPG filling plant, will be completed in 1962. A lube plant is planned for the third stage of construction.

The new refinery will improve General Bussan's foreign-exchange allocation position for additional crude purchases and will give the company access to additional products for marketing expansion. The company already has access to 7,000 bbl. daily from Toa Nenryo's Shimizu refinery and 8,000 bbl. daily from the Wakayama plant.

Toa Nenryo will furnish the engineering staff. Standard-Vacuum, through its parent companies, is a certain supplier of Middle East crudes.

## Australian Deal Is Made

A PRELIMINARY agreement has been made by Delhi Australian, Santos, and Frome Broken Hill to spend at least $2,045,000 in the initial 2-year period in joint exploration of 110,000-sq.-mile concession in the Australian states of South Australia and Queensland. With options, expenditures could total almost $11 million at the end of 5 years.

Delhi Australian is a subsidiary of Delhi-Taylor. The Frome Broken Hill group includes Vacuum Oil, subsidiary of Standard Vacuum, BP Exploration, Consolidated Zinc, Interstate Oil, Ltd., and American Metal Climax.

## Argentine Deal Rejected

IT WILL TAKE the personal hand of President Arturo Frondizi to salvage the multimillion-dollar oil development deal proposed by Atlas Corp.-Williams Brothers in Argentina.

Frondizi's new handpicked board heading up Yacimientos Petroliferos Fiscales, the government oil agency, last week turned thumbs down on the whole proposal. It is considered unlikely that the president will overrule the YPF board.

YPF complained that terms of the proposal are not the same as those originally proposed. YPF said the Atlas prices for drilling were higher than those offered by other companies. Atlas officials would not comment except to say they have had no official notification from Frondizi that the whole deal is off.

The Atlas combine talked in terms of a package $800-million deal when the proposal was made weeks ago, but Buenos Aires reports last week were that the final proposal involved drilling 2,000 wells in the Comodoro Rivadavia region at a cost of $350 million.

# *WORLD BRIEFS . . .*

**A contract** for processing units and pipe installations at the new 40,000-bbl. Esso refinery south of Oslo, Norway, has been awarded to Bechtel Corp. of San Francisco. Bechtel, in association with an American consulting firm, Sverdrup & Parcel, will do the work for A/S Esso-Raffineriet Norge. Preliminary work at the site is under way.

**Encouraging gas shows** were reported in a wildcat being drilled by Sun Oil of California on a structure near Maitland in New South Wales, Australia.

The wildcat hit the gas in a porous shale interval at around 500 ft. Projected total depth is 1,700 ft. Sun plans three more tests on the 363-sq.-mile drilling concession.

**Japan has renewed** a 12-month trade agreement with Russia permitting imports of 725,000 bbl. of Soviet crude. Only about 10% of this amount was actually imported under the last deal because of refiners' dissatisfaction with price and the requirement that Russian tankers be used.

**A third ethylene plant** will be constructed at Grangemouth, Scotland, for British Hydrocarbon Chemicals. The project, to be completed by July 1960, will be built by Stone & Webster Engineering, London. It will more than double British Hydrocarbon's present olefin capacity.

**Capacity of the 125,000-bbl.** refinery of Texaco Trinidad, Inc., at Pointe-a-Pierre will be doubled to approximately 250,000 bbl. Plans for the expansion have been approved by the Trinidad Government. The expansion will cost more than $18 million.

**A Sahara wildcat** has tested gas at the rate of nearly 5 million cubic feet daily. Hamra 2 is on the eastern edge of a concession held by Cie. des Petroles d'Algerie. It is located 260 miles southeast of d'Ouargla, and 180 miles northwest of Edjele field. Flow came from 6,890 ft. Royal Dutch-Shell has 65% interest.

**West German coal miners** are pressuring for a tax on fuel oil, and they probably will get their way before Christmas. Government officials promised the tax in order to make coal more competitive with oil. Coal stocks have risen to more than 13 million tons, causing layoffs of miners.

**Mene Grande Oil** has gone into the LPG business with the opening of a $7-million project in San Rosa field in Eastern Venezuela.

Up to 2,000 bbl. daily of LPG is shipped from the Santa Rosa cycling plant to Puerto La Cruz via a 65-mile pipeline. The product is stored in two 87-ft. diameter refrigerated tanks at the port, to await loading into tankers. Mene Grande will market LPG in Central and South America.

# TGT Increases Latin Activity

## . . . with purchase of producing properties, topping plant, Ecuadorian concession. Wildcats, development planned.

TENNESSEE GAS Transmission Co. last week doubled the size of its land holdings in Ecuador and at the same time acquired the second largest producing field in the country.

Santiago Petroleum Corp. sold its Ecuador holdings to Tennessee del Ecuador S.A., a wholly owned subsidiary of the Houston-based gas-transmission company. Santiago got a cash payment of $1,700,000 and retained 3% interest in the producing properties. This will increase to 4% if and when Tennessee boosts production to 10,000 bbl. daily.

The Houston company got 1,530,000 acres of concessions held by Santiago, including the 38-year-old Cautivo-Tigre field and a 1,700-bbl. daily topping plant.

Tennessee has agreed to spend a minimum of $870,000 for exploration during the next 2 years.

Until recently the Ecuadorian concession was operated by Manabi Exploration Co. This firm was absorbed by Santiago, a subsidiary of Pan Israel Oil Co., and Israel Mediterranean Petroleum Co.

Cautivo-Tigre field was discovered in 1920 and has produced more than 9 million barrels of oil. The first 6 months of this year the field's output averaged 1,393 bbl. daily from 175 wells.

Tennessee Gas will add the acreage it acquired from Santiago to another 1,500,000 acres of exploratory concessions it acquired directly from Ecuador in October. The original acreage is in west central Ecuador where there is no production. All of Ecuador's existing fields are on the Santa Elena Peninsula.

The Ecuador venture is the third Latin American oil deal for Tennessee Gas. A wholly owned subsidiary, Chaco Petroleum S.A., is now drilling a deep test on a 900,000-acre Bolivian concession in which it holds a 35% interest. Tennessee Venezuela, S.A., has a 15% interest in a Lake Maracaibo block with six new oil producers.

## Papua Find Discouraging

THE ELEVENTH-HOUR oil discovery in Papua, New Guinea, is turning in a poor performance on production tests.

Australian Petroleum Co. says on the basis of prolonged testing, Puri 1 in Australian New Guinea would produce comparatively small amounts of oil on continuous production. But the well has prompted the company to plan further exploration and drilling in the area.

Puri 1 was to have been the final well in a disappointing $67-million exploration program that has been under way for 22 years. (OGJ, Nov. 24, p. 61). The well came in at 1,000 bbl. daily, but water encroachment gave immediate trouble. Partners in the search are British Petroleum, Stanvac, and a local company, Oil Search.

# Gabon Discoveries

## made by SPAEF in Cap Lopez and Pointe Clairette areas.

TWO MORE discoveries have been made in Gabon, French Equatorial Africa, by the French company which has developed 11,000-bbl.-daily crude production in the area.

The finds were made by SPAEF in the Port Gentil region of the Atlantic Coast. CL-35 in the Pointe Clairette area yielded 2 bbl. in 8 minutes from 2,870-2,900 ft. LO-5 in the Cap Lopez area gave up 14 bbl. of crude in 12 minutes from a 75-ft. sand topped at 5,540 ft.

The wells are located in a region of Gabon which SPAEF has reserved for its own exploration and development. Present output of 11,000 bbl. daily comes from three small fields discovered 2 and 3 years ago. Three more small fields discovered since then are shut in.

Some other parts of SPAEF's big concession in Gabon and Middle Congo will be explored jointly. The company has made an agreement for joint work on two blocks with Socony Mobil and on one block with Royal Dutch Shell (OGJ, Oct. 13, p. 87).

# *the* JOURNAL *said . . .*

## 50 years ago

**December 20, 1908**

The following is from the testimony of John D. Archbold, vice president of the Standard Oil Co. of New Jersey before the referee at New York in the case of Government against the company.

"A great many more wells are usually drilled than are necessary. There is generally an unnecessary expense because of this. I have made it a practice in dealing with intelligent producers to ask them not to drill within so many hundred feet of each other. In Oklahoma the government has a regulation in this regard."

Humble field remains in the place it has occupied for several months as the most active of the Gulf Coast fields, reporting 18 completions in the first half of December, of which 14 were producers with 4,020 of initial production. Four were dry.

## 25 years ago

**December 21, 1933**

This winter refiners are supplying better quality motor fuels than ever before. This is particularly true of the so-called "regular" or middle-priced grade. At present the regular grade of typical gasoline is shown to have an octane number of 69. One year ago it was 65 and the year before was 61.

With the approval of stockholders of the Socony-Vacuum Corp., it is certain that the plans to merge the Far East properties of the corporation with those of the Standard Oil Co. (N. J.) in the formation of a new foreign unit will be carried out.

It is expected that all details in connection with the operation of the new company, to be known as the Standard-Vacuum Oil Co., which will control properties valued at $150,000,000, will be completed shortly after the first of the year.

## 10 years ago

**December 23, 1948**

If any wildcatter hunting for oil stubs his toe on 9,000 tanks, the Army will appreciate hearing about it for, believe it or not, it has "lost" that many of the 25,000 tanks it estimated it had after the war.

The "missing tanks," which cost some $2,250,000,000, are just one of the deficiencies chalked up against the military services by a task committee of the Hoover commission.

The Department of Justice this week filed its long-expected suit to seize the oil-bearing tidelands of Texas and Louisiana. Atty. Gen. Tom C. Clark said the two states are "defying" federal rights by granting leases for the production of oil from pools underlying the submerged lands off their coasts.

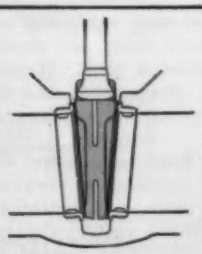
Safety-Minded Refiner Uses
CRANE Valves on Ultraformers

# CRANE flexible disc gates hold hot hydrocarbon where other valves can't

The job of isolating the hot hydrocarbon from oxygen-containing regeneration gas in Ultraforming units is given to Crane 14-inch, 600-pound steel gate valves with a *flexible* disc. Once the valve is closed, inert gas is injected between seating faces to purge all traces of hot hydrocarbon. Crane motor-operated valves of the type pictured have performed successfully in Ultraforming units for more than four years.

Ordinary solid wedge gate or plug-type valves cannot provide the positive upstream seating demanded for this and similar refinery operating conditions. The Crane *flexible* wedge disc greatly minimizes the possibility of seat leakage caused by line strains or by uneven temperature or pressure conditions.

For complete details about Crane *flexible* wedge disc gate valves for process or power piping, see your Crane Representative or write to the address below.



Showing positive wedging principle of Crane flexible disc gate valve.... holds tight at both seat faces...upstream and downstream. Also overcomes sticking of disc when closed hot and opened cold.

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# Get better completions with

# Modern drill-stem testing

## New tools and correct procedure lead to success in new wells and workovers

BY W. B. BLEAKLEY
Production Editor

THE DRILL-STEM TEST is one of the most informative methods of evaluating a formation and the type of completion which should be made in that formation. A test made incorrectly will not only lead to a poor evaluation of the reservoir, but it may also permanently damage the formation in the vicinity of the well bore.

Several new techniques have been developed recently for drill-stem testing. Use of one or more of these techniques, plus proper selection of older methods, will result in much better testing and ultimately in more production from your wells.

New developments in this field include:

1. A wire-line retrievable tester, which can be run and operated without pulling the drill pipe.
2. Acid formation cleaner.
3. Straddle-packer tester without anchor pipe.
4. Support for small packers to prevent extrusion in large bore holes.
5. Combination tool with inflatable packer for testing in open hole.

This article presents a discussion of these new developments and shows how they can be used in combination with proven older methods.

**Accessory equipment . . .** Several auxiliary items are available for drill-stem-test tools. These may be used to obtain more or better data, or to expand the usefulness of the tool.

**Retrievable tester:** With this tool, it is possible to perforate, treat, test, squeeze, and perforate a new zone without pulling the tubing. Fig. 6.

The basic part of the tool is run on the tubing. It includes the packer, drag springs, and slips, and treating and squeezing operations can be carried out through its unobstructed inside diameter. The tester part is lowered through the tubing and locked in position, by wire line or pumping or both.

After the formation has been tested for fluid and closed-in pressure, the tester can be removed by wire line or pumping. Multiple operations can be performed without exposing the formation to drilling fluid. If it is desired to squeeze the perforations and move to a different depth, this may be done without pulling the pipe.

**Acid formation cleaner:** A recently developed test tool features an acid pump between the closed tester and a disk valve. The pump retains the acid with added surfactants until the perforated anchor is opposite the formation to be tested. Application of drill-pipe weight forces a plunger downward which displaces the acid out through the perforations. Fig. 7. The face of the formation is cleaned by acid action. The displaced mud goes through a bypass valve to the annulus.

A normal test follows, with the spent acid going into the drill pipe along with the formation fluid. This tool gives better than usual results where filter cake and water invasion normally cause poor tests.

**Two packer tests:** Some operators prefer to drill through suspected pay zones, with the intention of running an electric log of the entire well with subsequent evaluation of likely looking zones. Testing of zones not at the bottom of the well, or at least above another porous zone requires the use of two packers; one to hold back the drilling fluid from above, the other to isolate the zone from below.

This tool features a bypass to put the drilling fluid above the top packer in communication with that below the bottom packer. Fig. 8.

Some straddle-packer arrangements require a supporting anchor to be used to set the bottom packer while others use slips that engage the side of the hole. The type that requires no anchor will permit the testing of several zones without pulling the drill pipe to change the length of the anchor.

**New combination tool:** A recently developed tool permits the treating and testing of formations off bottom in open hole. This permits the positive evaluation of formations during drilling operations, before money has been spent for casing.

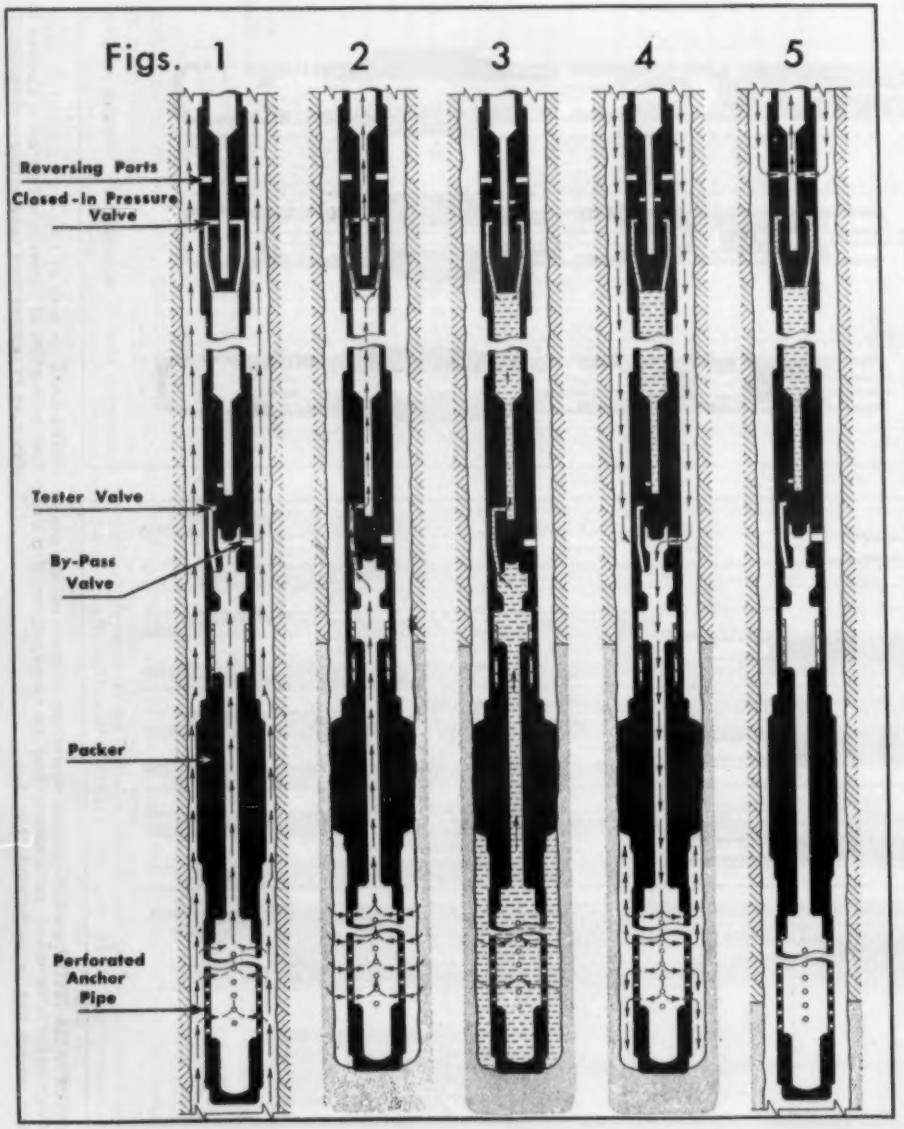
This tool, Fig. 9, utilizes the straddle-packer technique, but uses inflatable packers. The packers are set by the application of drilling-mud pressure, and drill-pipe weight is not needed. The tool is also available with a single packer arrangement for testing on the bottom.

Since some reservoirs need stimulation before commercial production can be obtained, an ordinary drill-stem test would be inconclusive. With the new wildcat tester, the formation may be acidized, or otherwise treated, then tested. Since testing is done by swabbing, tubing should be used instead of drill pipe. Roughness of drill pipe, due to erosion, usually makes swabbing inefficient because of damage to swab rubbers.

The tool may be set and reset many times during the same run in the hole.

**Bottom-hole choke:** There are three basic types of chokes used in drill-stem testing, the fixed type, the automatically adjustable hydraulic type, and the mechanically adjusted type. The use of a choke is desirable because: (1) It reduces the flowing pressure at the surface, making the testing operation safer. (2) It gives weak wells a better chance to flow and clean up by making more efficient use of energy of the expanding gas. (3) It prevents damage to the producing formation by holding a back pressure. (4) The choke prevents rapid pressure changes from being imposed on the formation, the packer, and the pressure-recording instrument.

The fixed choke could be placed almost anywhere in the test string, but the best position is below the equalizing valve so that it may be




# What's the function of a d. s. t. tool

**Basic features . . .** A drill-stem-test tool must perform several functions to be successful. It must:

**. . . Allow the drill pipe** with tool attached to be lowered into the hole without swabbing action.

**. . . Relieve the formation** of hydrostatic pressure so that formation fluids may enter the well bore, the tool, and finally the drill pipe.

**. . . Seal off the drilling fluid** so that the formation sample is not contaminated.

**. . . Permit the formation fluid sample** to be circulated out of the drill pipe.

**. . . Obtain a record** of the formation pressure.

**. . . Permit the pressures** above and below the tester to be equalized after the sample is obtained.

These functions and others can be performed because of a complex arrangement of valves and moving parts within the tester.

**Going in the hole . . .** A buildup in pressure below the tool is prevented by a normally open bypass valve. This valve permits some of the drilling fluid to pass through the mandrel of the tool and out into the annular space, so that all of the fluid need not squeeze past the large-diameter portion of the tool. The valve is closed when the packer is set. This same valve will be used later to equalize pressure, and to prevent swabbing the well when pulling the tool. Fig. 1.

**Tool opposite the sand . . .** The packer is set, isolating the perforated portion of the test tool from the drilling fluid above the packer. The tool is opened and the formation fluid is allowed to enter the drill pipe. Opening the tool is accomplished in different ways, depending on the manufacturer and type.

Some valves can be opened by imposing the weight of the drill pipe, and some by rotation of the pipe, or a combination of these operations. Fig. 2.

**Taking formation pressure . . .** If the tool includes a formation-pressure tester, it can be exposed to shut-in pressure by closing the valve that admits formation fluid to the drill pipe. This will allow the bottom-hole pressure to build up to reflect the true reservoir pressure. Fig. 3.

Before unseating the packer, the pressure difference across it must be equalized. This is done by opening the bypass valve. Fig. 4.

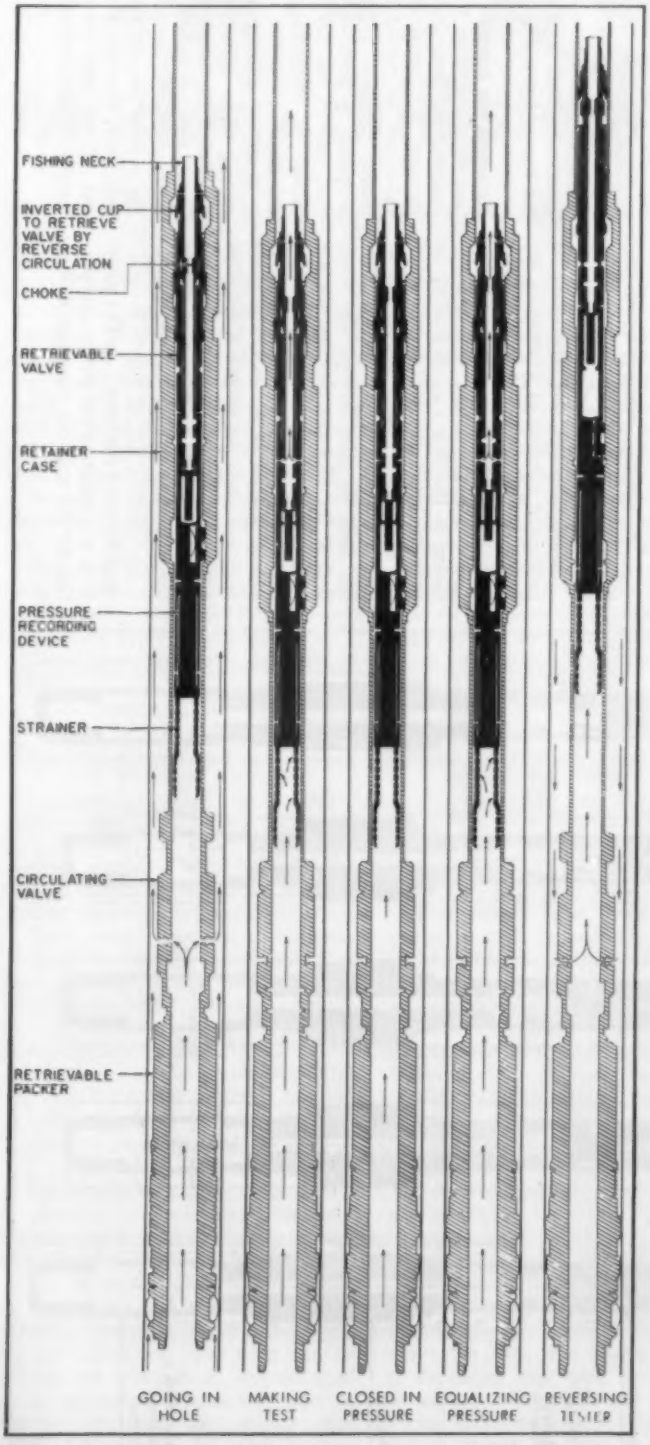
**Reversing the sample . . .** The formation fluid sample in drill pipe may be removed by reversing the mud flow through the circulating valve. This valve may be opened by pipe manipulation, pressure application, or by dropping a go-devil. Reversing the fluid out of the drill pipe can save money by eliminating oil or water-cut mud.

Removing a string of drill pipe containing oil is a fire hazard which is eliminated by reversing the recovery out of the pipe before pulling it. This is especially true on power rigs, where the engines are not far from the derrick floor. Finally, reversing the fluid out of the pipe provides a cleaner sample for evaluation. Fig. 5.

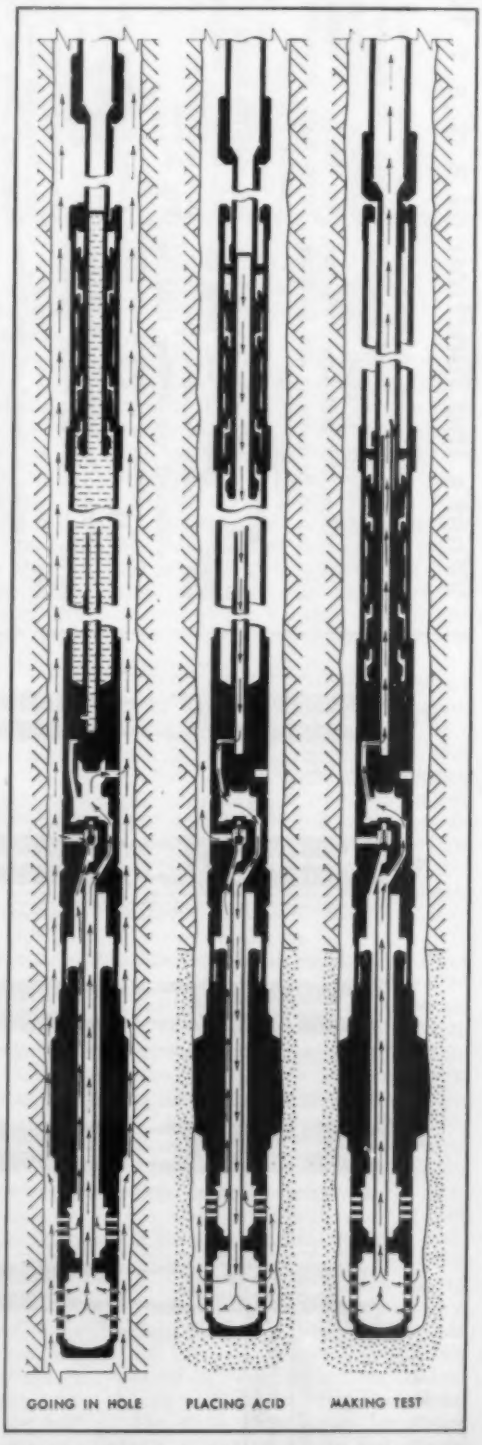
backflushed in the event it becomes plugged.

The adjustable hydraulic choke is constructed so that it begins the test with a small diameter which expands as the pressure builds up. This reduces the shock on the equipment when the tester valve is first opened, but allows the well to produce without too much restriction once pressure differences have been controlled.

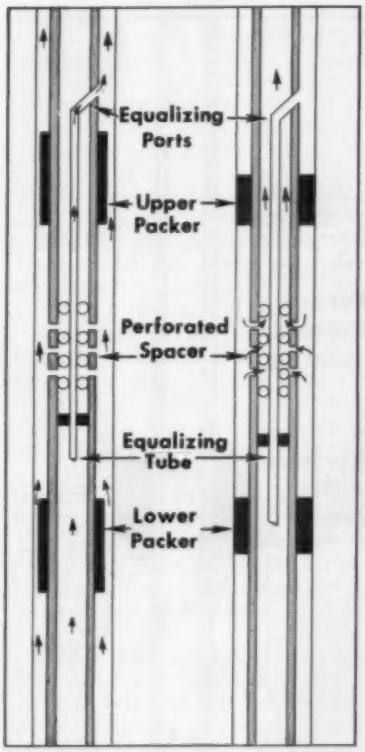
**Jars:** In cable-tool drilling, jars are used to continually force the bit from the bottom of the hole by applying an upward impact. They serve a simi-




**RETRIEVABLE TESTER** permits several operations without pulling pipe. After tester is removed, perforations may be squeezed, or, if a dry test, casing can be perforated. Fig. 6.




**FILTER CAKE** on wall of hole may prevent an accurate evaluation of formation. Formation cleaner is designed to remove mud cake before testing. Fig. 7.



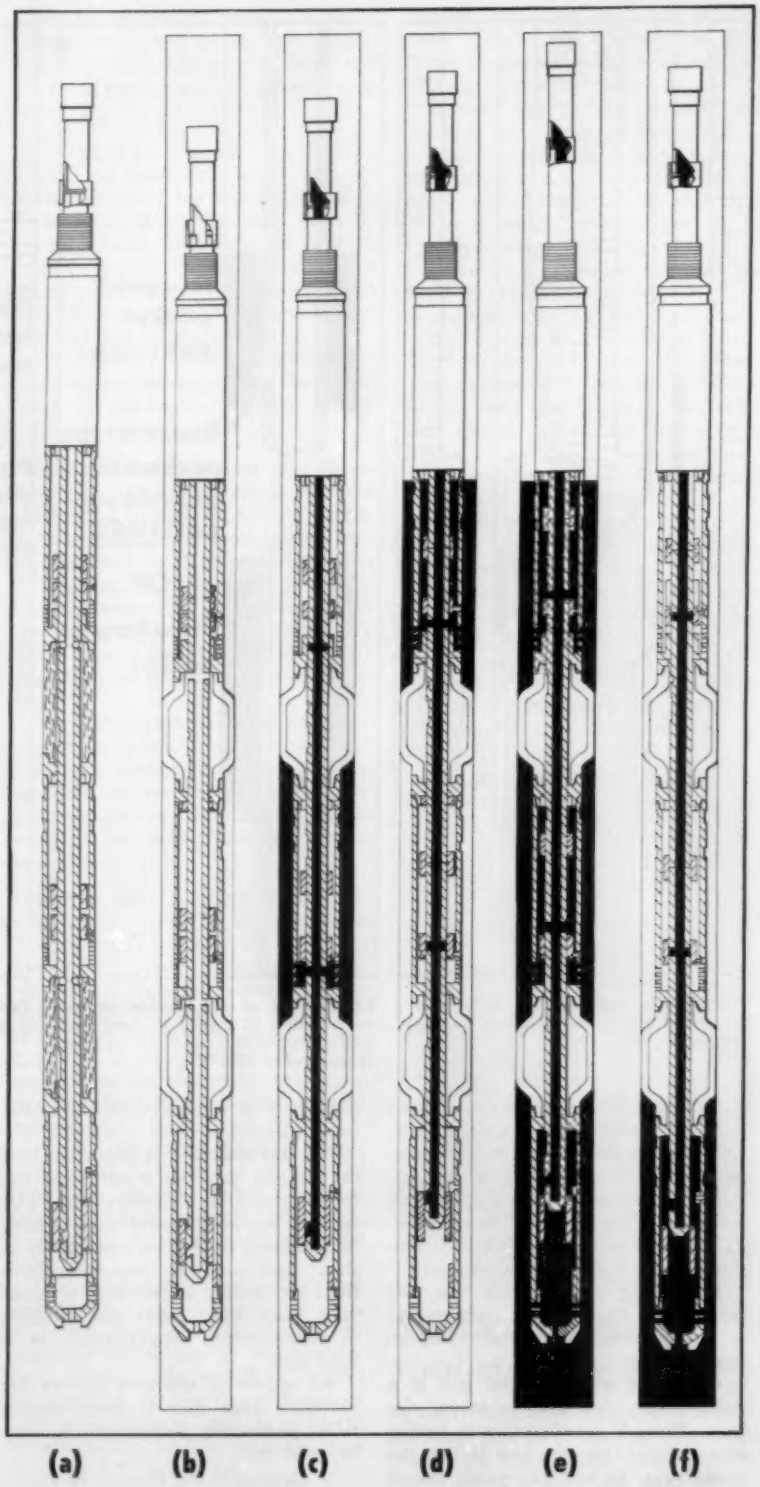

**TWO PACKER TESTS** are used in open hole where the formation to be tested is not on bottom. Fig. 8.

lar purpose in drill-stem testing. After the tool has been in a well for a period of time, sloughing shale or other solid matter may settle around the tool and tend to stick it.

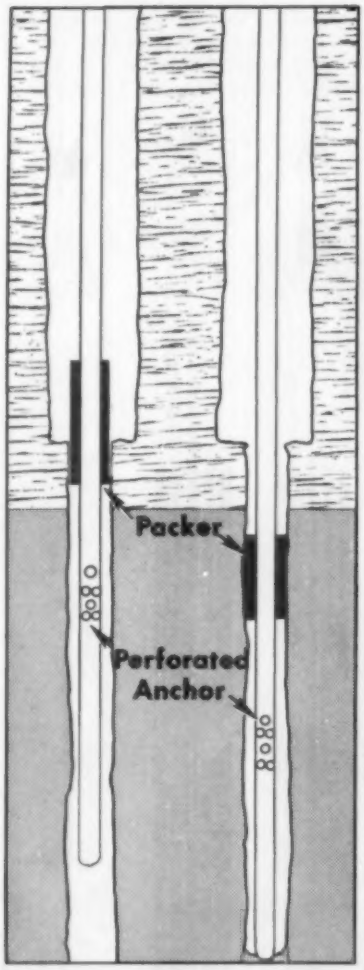
Jarring the tool may be necessary to break it loose. Jars are hydraulically operated, utilizing pressure or pressure differences in the inner parts of the apparatus to provide the necessary blow to free the stuck tool. The magnitude of the blow can be determined on some tools by the amount of pull on the drill pipe. Mechanical jars are also available.

**Safety joint:** If the jars fail to pull loose a stuck test tool, more drastic measures may be required. Most tools are equipped with a safety joint that will free the tool from the drill pipe. The pipe is then pulled and heavier jars and other equipment may be used to retrieve the fish, or the test tool can be drilled if it is made of brass and cast-iron parts.

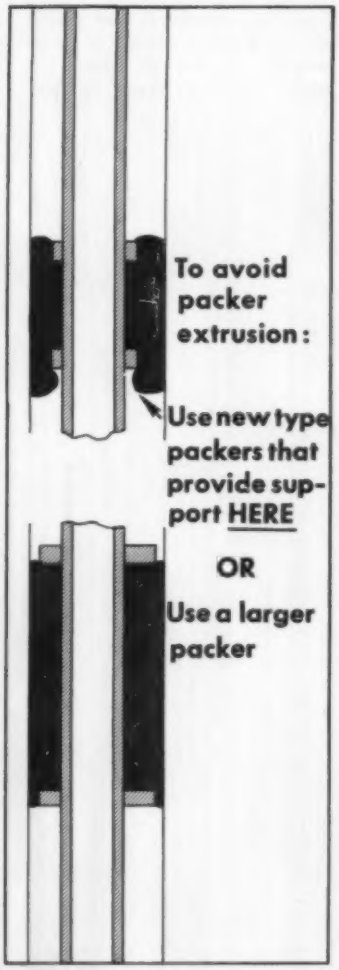
These safety joints are usually constructed so that separation will not occur accidentally but, with proper manipulation of the pipe, separation is easily obtained. One type, for example, requires an upward pull on the drill pipe along with right-hand rotation. This eliminates the possibility of unscrewing a tool joint in the process.



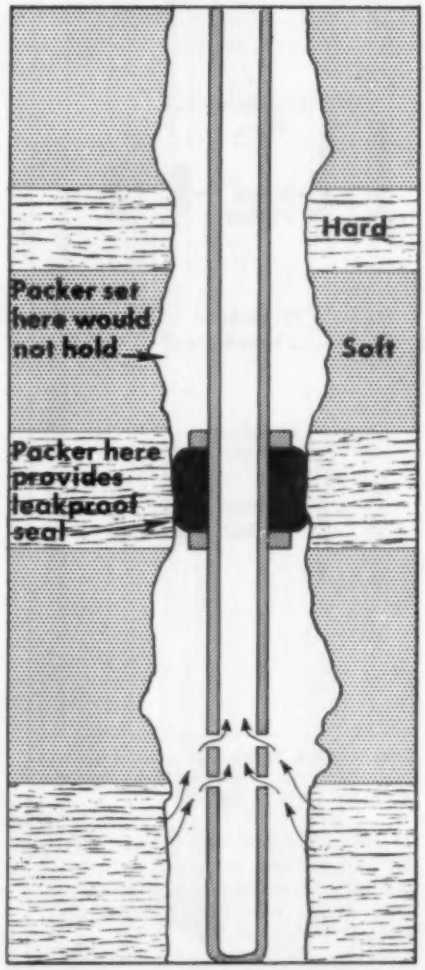

**NEW COMBINATION TOOL** with inflatable packers: (a) going in hole; (b) packers inflated; (c) this arrangement of valves permits testing or treating of the zone between the packers; (d) mud in the annulus can be circulated and conditioned while keeping the zones to be tested in isolation; (e) with the valves in this position, the pressures around the tool are equalized and the packers can be deflated in preparing to move to a new position; (f) this valve position allows treating and testing operations to be performed on a formation below the tool. Fig. 9.




**TESTING** in reduced-size core hole can be done with minimum packer clearance. Fig. 10.




**EXTRUSION** of the packer should be avoided to insure a good seal and a successful test, as well as long packer life. Fig. 11.




**PACKER SEATS** should be chosen carefully if a good test is to be obtained. Fig. 12.

Drill-stem tests may be run in open holes or cased holes. Open-hole testing permits the evaluation of prospective formations without the expense of setting pipe. Further, all suspected formations can be economically tested so that a potentially productive well will not be abandoned.

In making an open-hole test, the problem of choosing the right packer is an important one, which will be covered later.

Open-hole tests may be run in a reduced-size core hole or in full-size hole. There is an advantage in testing in a reduced-size core hole in that the packer can be smaller, which results in greater clearance between the packer and the wall of the hole during most of the running in. Fig. 10.

**Small clearance . . .** In a full size hole, the packer must be only slightly smaller than the hole itself, and there may be some trouble due to the small clearance.

For this reason, it is important that the drilling mud be conditioned before running a drill-stem test. The wall of the hole should have a thin, impermeable filter cake, particularly in shale and sand sections. Excessive fluid loss should be avoided, to eliminate thick filter cakes and swelling of clays, which would result in a tight hole.

An open-hole test may be run for purposes other than to locate potentially productive formations. It may be used to:

1. Determine the location of perforations for proper gas-oil ratio after casing is set.
2. Determine the oil-water contact.
3. Determine point of lost circulation.
4. Obtain water samples for laboratory analysis.
5. Test a fresh-water sand.

Testing in a cased hole is essentially the same as in an open hole except for the type of packer used. There is no filter-cake problem to be encountered, but the mud should be conditioned so that there is no debris in the hole, and so that the tendency for gelation and solidification is reduced.

Cased-hole testing is used for:

1. Testing productivity through perforations.
2. Testing a formation below the casing.
3. Testing for water shutoff after cementing.
4. Locating a hole in the casing.
5. Determining water-oil or gas-oil contacts by testing, squeezing, reperforating, and retesting.

**Which packer . . .** The use of anchor-type packers is common in open-hole

drill-stem testing. This type utilizes an anchor pipe to the bottom of the well. The purpose of the anchor is to provide a support for the lower part of the packer so that the weight of the drill pipe can be applied to the tool and expand the rubber packing element.

This is a convenient arrangement, and insures that the packer is expanded at the chosen depth. The length of the anchor pipe determines the packer location.

**Exceptions to this** are tools that have been developed for testing in open hole that use the hook-wall packer and the inflatable packer. With either type, tests may be made in open hole, off bottom, using the straddle-packer technique. Each permits the tool to be moved to a new location without pulling the drill pipe.

In some cases, the inflatable-type packer may have an advantage, because it will more easily conform to irregular walls of bore holes.

**Testing in a cased hole** is normally done with a wall packer. This type is equipped with slips that grip the wall of the casing, and support the packer so that the weight of the drill pipe can be applied to expand the packer rubber. The slips are held in a collapsed position by a set of J-hooks, as in the hook-wall packer, or by a frangible disk, as in a disk wall packer,

The J-hooks are freed from their slots by rotation of the drill pipe, while in the other type the disk is fractured by dropping a go-devil down the hole.

The result in either case is the same: the slips are free to expand to the wall of the casing, and the application of drill-pipe weight will force them against the pipe, where they will dig in sufficiently to support the drill-pipe weight.

**What size packer? . . .** The presence of a thick filter cake on the wall of the hole can cause trouble. This is because the clearance between the packer and the hole must be held to a minimum, and a thick filter cake would be forced into the bottom of the hole.

Small clearance space is necessary to insure that the packer is expanded against the wall of the hole without using all of the vertical travel available in the packer joint. Available data indicate that the ratio of hole size to packer size should be of the order of 1.08 to 1.1 for a conventional packer. For an inflated packer, this ratio can be 1:5 to 1:8.

Some new packers are equipped with extra expanding rubber or metal supports to prevent the packer rubber from being extruded beyond the design limits. A packer having this feature can be used in a larger hole than could a conventional packer of the same size. Fig. 11.

**How large an interval? . . .** In most cases, the most satisfactory tests are obtained when the tested interval is 2 to 10 ft. thick. With this short interval, gas-oil and water-oil contacts may be located. Further, there will not be so much drilling mud contained in this short interval that the results of the test will be obscured.

When testing massive limestone formations, and the location of the porous zone is unknown, a much greater interval is recommended.

**Where to set the packer? . . .** Open-hole tests should be carried out with the packer located at a hard formation, where the hole is not washed out. A competent sand bed or a limestone is satisfactory. Shales tend to soften in the presence of drilling mud, and the exposed surface is unsatisfactory for a packer seat. Fig. 12. A caliper log will show where the hole is of true gage.

On successive tests at the same approximate depth, a new location for the packer should be chosen, if possible. Two packers are sometimes necessary to prevent fluid bypass when using a fractured formation for a packer seat.

**Length of test . . .** There are two important factors to be considered in determining how long the test tool should be left open. These are in addition to the demands according to the type of test to be run. If the test is being made simply to determine the fluid content of the formation, a long test may be desirable to insure that the reservoir fluid has an opportunity to enter the well bore.

On the other hand, there is danger involved in keeping the tool in the hole any longer than necessary. Sloughing shale and the thixotropic property of the mud may result in a stuck tool.

During normal drilling, mud filtrate will enter the porous formations. On a drill-stem test, this filtrate must be produced before any of the reservoir fluid can enter the well bore. A tool left open for an insufficient length of time may recover nothing but the filtrate water, and a potential producer may be passed up.

**Cushions . . .** Opening the drill-stem test tool to an empty string of drill pipe may impose an immediate pressure reduction on the face of the formation to be tested. This could result in serious, permanent damage to the sand by encouraging water or gas coning. Some of the rock material may actually be displaced and the loose fragments will fall around the anchor, tending to stick it.

Futher, the sudden pressure differential may cause packer failure.

These large, instantaneous pressure differences can be eliminated by the use of a fluid cushion in the drill pipe. Water is usually used but gas can be employed when available.

Either high-pressure natural gas from an adjacent separator or plant, or bottled nitrogen will work satisfactorily. Gas is convenient to use since the surface pressure is a fairly close indication of the pressure at the packer, and the gas can be easily bled off to reduce the pressure at will.

A new development in this respect is a control valve that is used in the tubing to control the pressure of a nitrogen cushion. This valve, which can be located anywhere in the tubing, can be set to hold any desired amount of back pressure. As flowing pressure increases, the valve opens, permitting recovery of the formation fluids. At completion of the test, the valve traps the fluid at the preset valve pressure, preventing contamination of the fluid sample.

Information in this article was obtained largely from literature published by the following: Cook Nitrogen Service, Halliburton Oil Well Cementing Co., Johnston Testers, and Lynes, Inc.

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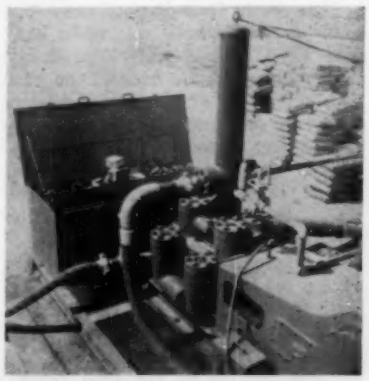


## Skid can provide tool-storage space

A CONVENIENT PLACE in which to keep the tool box for the mud pump and tools is the space on the skid right in front of the mud pump.

This allows ready access, and when the pump is moved the tool box is simply closed and moved right with the pump. Since the mud pump does not cover the length of the skid base, this allows plenty of space on the front.

REFINING

# Gamma rays + X-ray films = a new way to detect corrosion

BY E. G. PAUSCHENWEIN
AND P. C. TROUNCE
Canadian Oil Companies, Ltd.,
Sarnia, Ont., Canada

BY COMBINING GAMMA RAYS with X-ray film the inspection engineer can now record and plot corrosion with minute accuracy.

The use of isotopes and X-ray film to measure pipe and tube-wall thickness was first made at Sarnia refinery in 1957, and since that time standardized procedures, equipment, and measuring techniques have been developed to bring this method to the status of a major inspection tool.

Although the prime use of this development is the detection of metal loss, it is proving useful in many other aspects of inspection work. These include welding inspection and the reexamination of internal mechanisms.

### Application

This method of inspection is actually a fairly simple one when handled by a trained staff. The X-ray film is placed at the back of the pipe with the angle of the film predetermined for each pipe size. The gamma-ray source is then placed at a calculated distance from the pipe and on its center line. Again, the pipe size is the determining factor in the distance involved.

The length of gamma-ray exposure varies in relation to the pipe size, wall thickness, and the flowing medium. Exposure time is established carefully because it can have a significant bearing on the final results.

Experience has shown that excellent results are obtained on pipe sizes up to 6 in. in diameter without removing the insulation.

To obtain good results on larger pipe, it is necessary to remove insulation.

When very high temperatures are encountered, insulating material is placed between pipe and film to protect the film from overheating. The pipe or vessel does not need to be empty as long as the density of the internal medium is not identical with the density of the pipe material.

**Film results . . .** The area surrounding the pipe is always seen as black in the developed film. Gamma rays reach the film without interference, resulting in complete exposure. Depending on the exposure time involved, the view of the inside of the pipe can be produced in any required shade, ranging from dark gray to black.

Gamma rays traveling through the pipe wall between the outside diameter and the inside diameter of the pipe have to penetrate metal equal to about four times the wall thickness of the pipe. The rays cannot penetrate this thickness when the exposure time has been set for the wall thickness of the pipe.

Thus, most of the rays are absorbed by the metal leaving an unexposed area on the developed film. This area is seen in white on the film. It represents the projected image of the pipe wall, slightly enlarged. This image can be measured and a correcting calculation establishes the exact wall thickness of the pipe.

Any deposits or scale on the inside of the pipe show clearly on the developed film distinctly separate from the pipe wall. This "extra" information which the film records has already proved useful in determining the extent of iron sulfide scale thickness in catalytic reformer heaters.

Pitting, which up to now has defied detection by other instruments, is also clearly visible on the film.

### New Method at Work

The units at Sarnia refinery were scheduled in 1958 to complete their normal operating run in April. The question was asked whether safe operation could be continued until early fall. A check of the inspection records showed that most of our equipment could be safely operated for an extra 6 months. The only exceptions were some process piping and two crude-oil heaters.

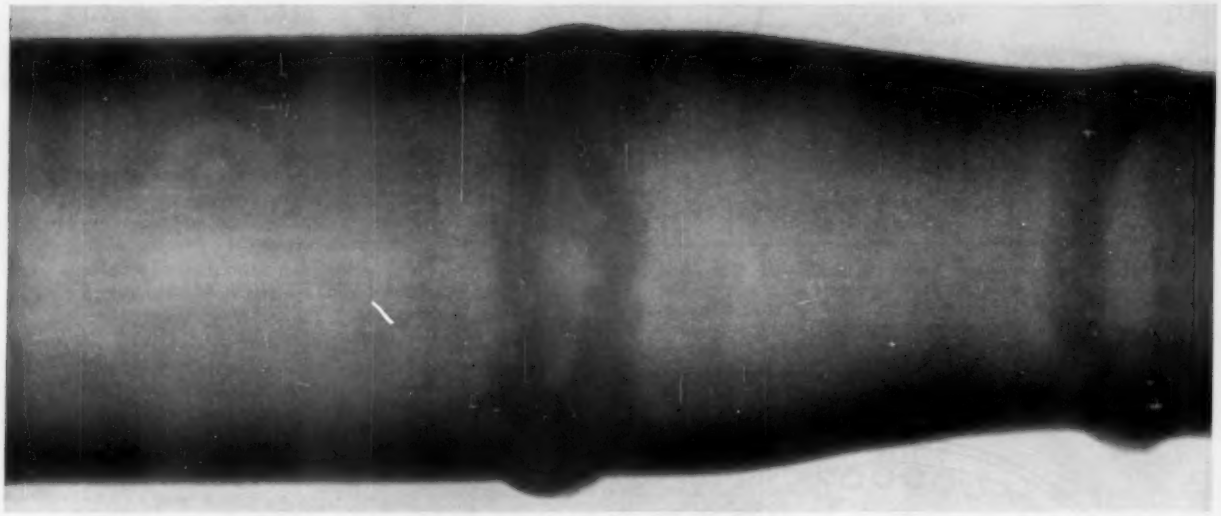
These exceptions were made because we were expecting higher corrosion rates due to an increase in crude throughput since the previous turnaround. To be on the safe side, the figures of established metal loss per year were doubled. These calculated figures were deducted from the readings taken during the previous turnaround.

The results indicated that some of the lines could be close to the retiring thickness. Since the gamma-ray inspection system had been so successful on a smaller scale we decided to use it for a complete inspection of all process piping carrying known corrosive media.

A list was prepared of all the lines to be inspected and the number of "shots" to be taken on each line. Existing pipe sketches were used to mark all inspection locations. These had been selected individually for each line, depending on the length of pipe, the pipe size, and the severity of service; 105 were selected in the crude unit and 40 in the catalytic cracking unit. About 80% of the pipe involved ranged from 1½ to 6 in. The remainder was 8 to 10 in. The operating temperatures of most of the lines was between 500° and 850° F.

The majority of the shots in the crude unit were taken without removing the insulation. The money saved by not having to remove and subsequently replace the insulation (which would normally have been required with other inspection methods) almost paid for the total gamma-ray inspection.

Three radiograph operators worked with one Canadian Oil process worker



**RADIOGRAPH PICTURE** shows a 2-in. process pipe handling atmospheric tower reflux, taken on the run. Dark areas indicate the relative thickness of the pipe wall. Note weld rings, where metal is thicker and the rays did not penetrate to the file in the exposure time allowed.

whose task it was to mark the spots on the lines as indicated in the drawings. In many cases the same location was examined as had been reported by other methods in earlier inspections. We had mechanical caliper or audiogage readings on file and compared these with the results obtained with the new method. We found that the current study gave us more exact and complete information than any previous records.

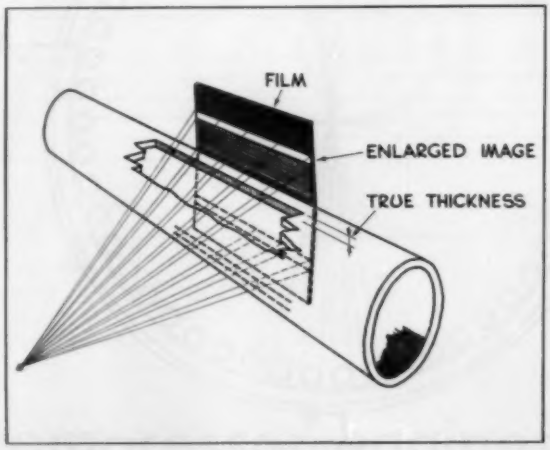
**Interpreting the results . . .** A conversion gage has been developed by the company to measure and interpret the film results. It combines a gage and a slide rule to convert the readings recorded on film into actual thickness.

To test the conversion gage, two shots were taken of a corroded pipe—one when empty, the other when the pipe contained liquid. The inspector calculating the measurement was not advised of the wall thickness. His report was compared with results obtained after the same pipe had been dismantled, cut, and gaged with a micrometer.

The two reports matched each other almost identically. Variances were reduced to less than 0.001 in. The test not only validated the measuring instrument, but also the filming technique. Consequently, we proceeded with our inspection fully confident that we would obtain a complete and accurate report of the condition of our process piping.

The results of the gamma-ray inspections were compared with the thickness we had previously estimated. It had been assumed that the 50% increase in capacity since March 1957, might have led to a 100% increase in corrosion rate. We found that the average rise in the corrosion rate was about 75% and this meant that the piping could be safely operated for another 6 months.

None of the lines inspected exceeded the retiring limit and this was determined at a minimum cost without shutting down the unit.

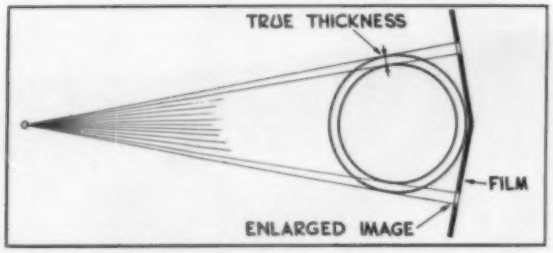



**ACTUAL IMAGE** captured on the film is larger than the pipe itself, since the rays pass on through the pipe and continue spreading until they meet the film as shown above. The image dimensions are then scaled down to correct proportions, and true wall thickness is obtained.

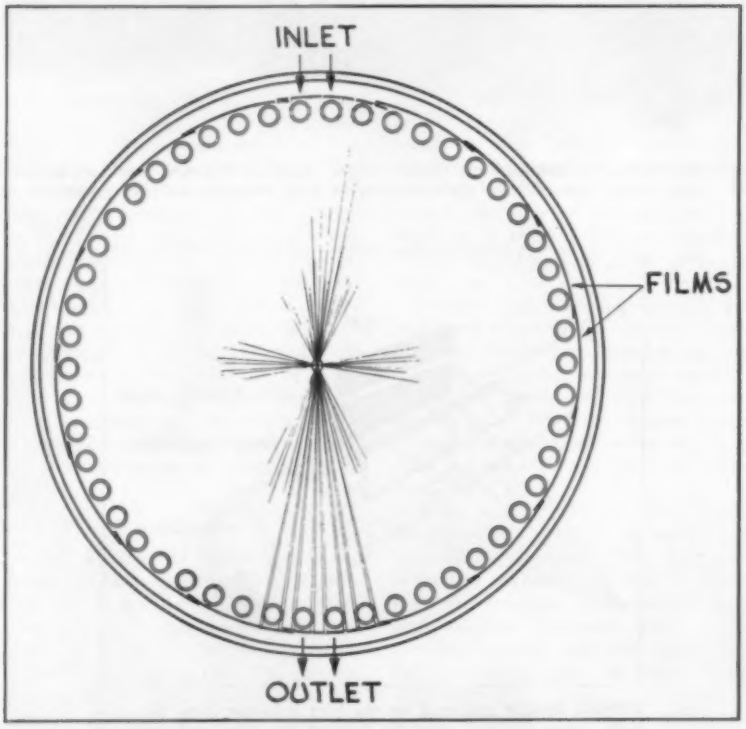
**Heaters also checked . . .** Once the process piping had been declared safe for an extra 6 months we tackled the job of checking the two primary heaters in the crude unit. Fortunately, these heaters are operated in parallel. By lowering the crude rate and increasing the load on one heater we were able to take the other out of service temporarily.

The inspection crew moved in and shot the heaters one at a time after the blanks required by safety regulations had been installed. No header plugs were removed and the tubes were full of liquid.

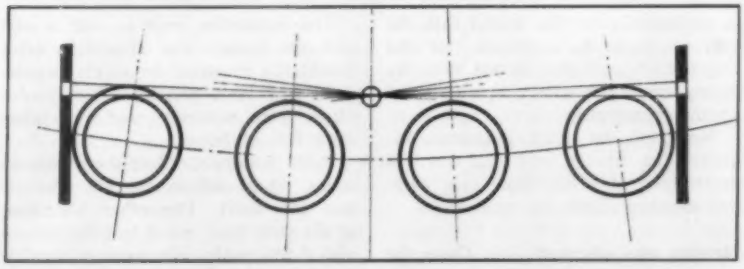
Both heaters are furnished with 48 tubes, 38 of which are 9% chrome and 1% moly. The other 10 tubes, at the inlet end, are 4 to 6% chrome and 0.5% moly. We were particularly concerned about the inlet tubes as it was expected that corrosion would be more advanced in them. Every tube had been inspected during the previous turnaround, using conventional methods — inside caliper, electrical tube caliper, and hammer testing. Readings with the electrical-tube caliper recorded over the last 3 years




**BETWEEN** the outside and inside diameter of the pipe, gamma rays must penetrate metal about four times thicker than the wall thickness of the pipe. Lack of such penetration in the exposure time shows the wall thickness on the film image.




**TUBES** in crude-oil heater were shot by placing films between the tubes and the heater wall, and exposing all at the same time to a gamma ray shot from the center of the heater.



**INDIVIDUAL SHOTS** were taken of the outlet tubes of the heater by special placement of the film and shooting gamma rays through the fire-side wall.

had shown that the thinnest spot in any of the tubes should be found approximately 10 ft. above the heater floor.

All tubes were shot at that height by the new gamma-ray method. The film was attached to the back of the tubes and by shooting towards the wall of the heater a picture 4 in. high was obtained of the complete tube. The two tube walls were clearly defined.

While no metal loss was revealed in the 9% chrome tubes, the 4 to 6% chrome tubes proved to be only 0.04 to 0.05 in. from retiring limit.

**Fire-side tubes . . .** Since heater tubes thin more rapidly on the fire side we wanted to have special pictures of that side. These were obtained by special placement of the film and shooting gamma rays through the fire-side wall. This resulted in a fire-side-wall picture about 17 in. in length which showed clearly any pitting and/or irregularities in the tubes.

Our analysis of the film indicated that even the thinnest tube was 0.02 in. above retiring, taking into consideration the established metal-loss rate of 0.04 in. per year. Thus, we decided to operate the heaters another 6 months, until the fall of 1958.

Again, the saving in labor and operating time was considerable. Other inspection methods, which would not have provided such dependable results, would have required the removal and replacing of some 200 header plugs. The cost of this operation alone would have amounted to several times the cost of the gamma-ray inspection.

A few weeks ago the 1958 turnaround of our Sarnia refinery was completed. At that time, some of the 4 to 6% chrome heater tubes were cut into 5-ft. lengths and examined closely. Of 16 tubes, 6 had reached retiring limits, while the remainder still had 0.02 to 0.03 in. to go.

During the recent turnaround all heaters in the crude unit and the catalytic reforming unit were inspected by the new method. They were also checked by conventional methods, but we anticipate that the gamma-ray inspection will provide sufficient information so that in the future the older methods can be dispensed with.

Another application that has resulted in substantial savings is the inspection of piping before a turnaround while the units are operating. This enables us to prefabricate replacement pipe, and we were able to make the maximum use of available skilled labor during the turnaround operations. This aids our over-all efficiency and also can be interpreted in terms of dollar savings.

It is hoped that the experiences reported here will prove useful to other inspection engineers working in the petrochemical and similar industries. The writer is indebted to Canadian Oil Companies, Ltd., and Sarnia Inspection Co., which played a major part in the development of the technique described, for their assistance and permission to publish this article.

TENNESSEE GAS TRANSMISSION COMPANY

COMPRESSOR CYLINDER DATA

| 1-10 |
|---|
| IDENTIFICATION |
| |

DATE: _____ COL. 66-71

CARD #10 COL. 79-80

| 11-14 | 15-18 | 19-22 | 23-26 | 27-30 | 31-34 | 35-37 | 38-40 | 41-42 | 43-45 | 46-47 | 48-50 | 51-53 | 54-57 | 58-61 | 62-65 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OPER. H.P. | CODE | DISC #1 PSIG | DISC #2 PSIG | DISC #3 PSIG | DISC #4 PSIG | R-MIN | R-MAX | INCR-R | K WF | TEMP | R.P.M. | D OF ROD | D OF PIST. | L OF STROKE | FIXED CLEAR |
| XXXX | XXXX | XXXX | XXXX | XXXX | XXXX | X.XX | X.XX | .XX | X.XX | XX | XXX | X.XX | XX.XX | XX.XX | XXXX |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

| CODE |
|---|
| $X_1 X_2 X_3 X_4$ |

AN 8 IN POSITION $X_1$ WILL COMPUTE VOLUME FOR $P_{SC}$=100 P.S.I.A.
AN 8 IN POSITION $X_2$ WILL COMPUTE VOLUME FOR GIVEN DISCHARGE PRESSURES.
AN 8 IN POSITION $X_3$ WILL COMPUTE H.P. FOR GIVEN DISCHARGE PRESSURES.
AN 8 IN POSITION $X_4$ WILL COMPUTE POINTS ON OPERATING CURVE FOR GIVEN HORSE POWER
IF AN 8 IS NOT USED, USE A 9.

ADDITIONAL CU. IN. CLEARANCE FOR POCKET POSITIONS

| 11-14 | 15-18 | 19-22 | 23-26 | 27-30 | 31-34 | 35-38 | 39-42 | 43-46 | 47-50 | 51-54 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | POCKET #2 | POCKET #3 | POCKET #4 | POCKET #5 | POCKET #6 | POCKET #7 | POCKET #8 | POCKET #9 | POCKET #10 | POCKET #11 | |
| XXXX | XXXX | XXXX | XXXX | XXXX | XXXX | XXXX | XXXX | XXXX | XXXX | XXXX | CARD # |
| 0000 | | | | | | | | | | | 11 IN COL. 79-80 |
| POCKET #12 | POCKET #13 | POCKET #14 | POCKET #15 | POCKET #16 | POCKET #17 | POCKET #18 | POCKET #19 | POCKET #20 | POCKET #21 | POCKET #22 | |
| | | | | | | | | | | | 12 IN COL. 79-80 |

REMARKS: _____

REQUESTED BY _____

Fig. 1.

Electronic computer provides a

# Daily check on compressor engines

## with the result . . .

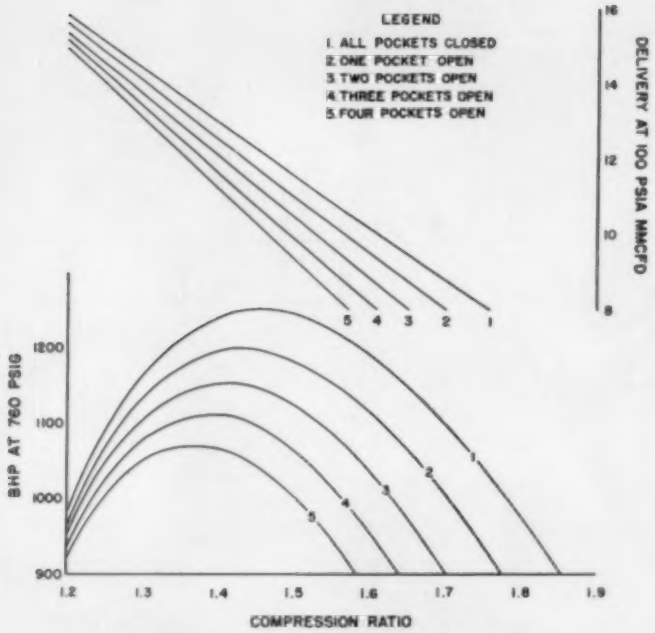
**Operating management control of the performance and maintenance of over 500 compressor engines has been made more effective through the use of a medium-sized electronic computer. Information that heretofore was virtually impossible to gather for even special studies is now available daily at Tennessee Gas Transmission Co. From the daily compressor-station reports, the source data are key-punched and fed into the computer along with a large volume of fixed master-card data to produce a computed report, listing for each engine the horsepower-hours, calculated volume, oil use, repairs, and various operating conditions. The different types of compressor engines may now be compared according to their loading conditions, compressing ability, and their parts usage.**

**BY JOHN MANRY, III**
Tennessee Gas Transmission Co.

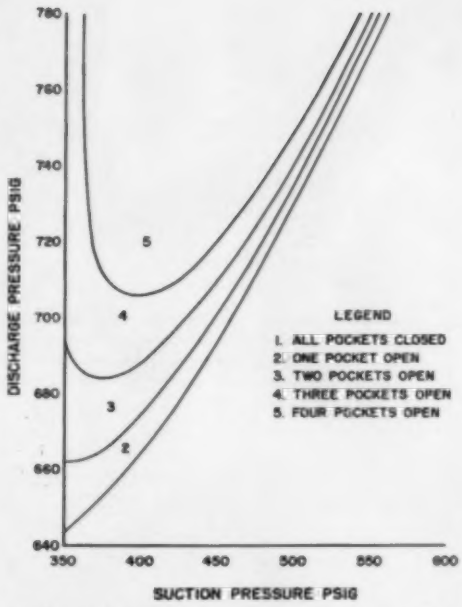
THERE HAS been a continuing need for more compressor-engine information as our company expands. The manually compiled reports have required more and more man-hours, and verifying the accuracy has been a tremendous task. Answers were needed about the compressor-station performance to aid in pipeline design, operation planning, and parts studies. Since an uninterrupted flow of natural gas to market is a necessity, it is very important to be able to account for the millions of dollars spent for the maintenance and operation of the compressor stations.

**Analyzing the situation . . .** Prior to the actual electronic-computer pro-

Presented at thirteenth annual ASME Petroleum Mechanical Engineering Conference, Denver.




**PERFORMANCE CURVES** are plotted with computer-produced points. Fig. 2.




**OPERATING CURVES** aid operators in loading engines. Fig. 3

graming, a joint study was made by the compressor and systems and data-processing departments. An electronic-computer planning group was formed and carried the job through from start to finish.

A survey was made of all compressor-station reports compiled at the field locations and the main office. Some of the information being submitted to the main office regularly from all stations was found to be of little value for use by anyone. An example of the type of information not needed for further data processing or computing would be the starting air pressure maintained in the engine buildings.

Many of the numbers written down on a daily compressor report are noted primarily as a checkoff list. By submitting for data processing only that information to be used as part of a permanent record, a saving could be made in weight of paper mailed, and bulk of paper handled in the main office could be cut down.

**Setup of compressor stations . . .** The company compressor stations have 1 to 3 buildings with as many as 15 engines per building. The main compressor engines generally run from 1,000 to 2,000 hp. For a large station having nearly 40 engines, it required several man-hours to average and total the daily compressor reports and enter them on a monthly station report.

These monthly reports showed average and total hours run on each engine, oil used in the power cylinders, crankcases, and compressor cylinders. Other information tabulated was the atmospheric temperature, in-gas temperature, out-gas temperature, suction pressure, discharge pressure, auxiliary-engine-hours run, and auxiliary-engine oil used. Considerable time was spent in making the numbers on these reports balance, and the main-office comptometer section verified and corrected as necessary these monthly reports.

One report that was difficult to calculate was a monthly station-efficiency report. This involved computation of the amount of gas compressed by each engine type from the performance curves and dividing the total of all the gas computed for each engine by the gas compressed at the station.

The gas-compressed figure was furnished by the gas control department. To make this efficiency calculation, 1 day each month was chosen for each station. An attempt was made to select a steady-flow day since the calculations became quite involved if there was much engine switching and unloader pocket changing as a result of large pressure changes.

Another time-consuming report was the engine repair and down-time report. In this report approximately 35 engine-repair categories, including miscellaneous, were used to account for the repair time.

The field personnel compiled a monthly report from which the main office made further reports and studies of parts usage according to engine type and manufacturer. An example of a special study made under this system was a compressor-valve-replacement report showing comparisons of valve breakage between valve types and materials.

Before inauguration of the computed daily compressor reports, a machine-computed performance curve and operating curve were made for each type of engine at the stations. Basic compressor cylinder data were supplied by filling in the appropriate blanks as shown in Fig. 1.

By computing the swept volume and using a compressor formula, the program produced all the points necessary to plot the performance curves as shown in Fig. 2, and the operating curves as shown in Fig. 3. The operating curves are used by the station operators to load the engines to capacity as necessary.

**Daily compressor-station summary . . .** The computed daily compressor-station summary is tabulated on a printed form for each station. Information about the operation of each engine is listed and comparisons may be made at a glance between the engines. This report is shown in Fig. 4.

The calculated volume and the developed horsepower for each engine are numbers that heretofore were calculated manually from engine-performance curves. The compression ratio and the horsepower-hours are

DATE: 4-26-58 STATION 1

TENNESSEE GAS TRANSMISSION CO.
DAILY COMPRESSOR STATION SUMMARY

| ENGINE NUMBER | OIL-QUARTS | | | TEMPERATURES | | | R.P.M. | AVERAGE GOVL. | PRESSURES | | RATIO | CALCULATED VOLUME | RATED H.P. | DEVELOPED H.P. | HOURS OPER. | H.P. HOURS | LINE SERV. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CYLINDER | CRANKCASE | COMPRESSOR | IN | DISCH. | OUT | | | SUCT. | DISCH. | | | | | | | |
| 1A | 16 | | 5 | 83 | 135 | 78 | 280 | 6.0 | 500 | 765 | 1.51 | 38,601 | 1,000 | 861 | 24 | 20,664 | 3 |
| 2A | 12 | | 5 | 83 | 135 | 78 | 280 | 6.0 | 500 | 765 | 1.51 | 38,601 | 1,000 | 861 | 24 | 20,664 | 3 |
| 3A | | | | 83 | 135 | 78 | | | 500 | 765 | 1.51 | | 1,000 | | | | 3 |
| 4A | 8 | | 4 | 69 | 98 | 87 | 277 | 3.3 | 625 | 760 | 1.21 | 31,445 | 1,000 | 636 | 13 | 8,268 | 1 |
| 5A | | | | 69 | 98 | 87 | | | 625 | 760 | 1.21 | | 1,600 | | | | 1 |
| 6A | 8 | | 4 | 69 | 98 | 87 | 250 | 5.0 | 625 | 760 | 1.21 | 42,018 | 1,600 | 911 | 11 | 10,021 | 1 |
| 7A | 8 | | 5 | 69 | 125 | 83 | 280 | 5.0 | 625 | 915 | 1.45 | 38,708 | 1,600 | 1,343 | 13 | 17,459 | 2 |
| 8A | | | | 69 | 125 | 83 | | | 625 | 915 | 1.45 | | 1,600 | | | | 2 |
| 9A | 18 | | 6 | 69 | 125 | 83 | 299 | 5.5 | 625 | 915 | 1.45 | 82,257 | 1,600 | 1,490 | 24 | 35,760 | 2 |
| 10A | 20 | | 8 | 69 | 125 | 83 | 299 | 5.4 | 625 | 915 | 1.45 | 82,714 | 1,600 | 1,498 | 24 | 35,952 | 2 |
| 11A | | | | 69 | 125 | 83 | | | 625 | 915 | 1.45 | | 1,600 | | | | 2 |
| 12A | | | | 69 | 125 | 83 | | | 625 | 915 | 1.45 | | 1,600 | | | | 2 |

AUXILIARY ENGINE DATA

| ENGINE NUMBER | RATED K.W. | DEVEL. K.W. | HRS. OPER. | OIL ADDED |
|---|---|---|---|---|
| 1A | 250 | 189 | 24 | |

| ENGINE NUMBER | RATED K.W. | DEVEL. K.W. | HRS. OPER. | OIL ADDED |
|---|---|---|---|---|
| 2A | 250 | 181 | 24 | |

| ENGINE NUMBER | RATED K.W. | DEVEL. K.W. | HRS. OPER. | OIL ADDED |
|---|---|---|---|---|
| | | | | |

| ENGINE NUMBER | RATED K.W. | DEVEL. K.W. | HRS. OPER. | OIL ADDED |
|---|---|---|---|---|
| 4A | 250 | 125 | 24 | |

| OIL-QUARTS | | | | AUXILIARY H.P. HRS. | STATION H.P. HRS. | AVERAGE STA. H.P. | % EFF. | DISPATCHERS THRUPUT | CALCULATED THRUPUT |
|---|---|---|---|---|---|---|---|---|---|
| ENGINES | AUX. | OTHER | RE-CLAIM | | | | | | |
| 127 | | | | 15,945 | 148,788 | 6,200 | 94.67 | 335,449 | 354,344 |

AVERAGES PER LINE SERVICE

| SUCT PRESS. | DISCH. PRESS. | COMP RATIO | TEMPERATURES | | | | LINE SERV. |
|---|---|---|---|---|---|---|---|
| | | | IN | DISCH. | OUT | ATM. | |
| | | | | | | | |
| 73,463 | 625 | 760 | 1.21 | 69 | 98 | 67 | 79 | 1 |
| 203,679 | 625 | 915 | 1.45 | 69 | 125 | 83 | 79 | 2 |
| 77,202 | 500 | 765 | 1.51 | 83 | 135 | 78 | 79 | 3 |
| | | | | | | | |
| | | | | | | | |

**DAILY SUMMARY** offers quick comparison of engines based on computed volume, developed horsepower, compression ratio, and horsepower-hours. Fig. 4.

the other computed values for each engine. The remainder of the information for the individual engines is duplicated from the source data of a compressor-station form.

If you were reviewing the report of a compressor station that was known to be operating at full capacity, then you may at first be interested in the hours that each engine ran, and the horsepower that each engine developed. A field superintendent may have called your attention to the need for a special overhaul due to the poor performance of a specific engine, and this report helps develop a better mental picture of this engine situation.

**Operating data summarized . . .** On the lower part of this daily compressor-station summary, the oil is summarized for the engines, the auxiliary engines, the other station usage, and the reclaimed oil. Also summarized are the station horsepower-hours, and the calculated throughput. The average station horsepower is arrived at by adding up a computed developed horsepower for each engine.

The dispatcher's throughput is printed out and used to calculate the station efficiency dividing it by the calculated throughput. Actually this efficiency number is the volume computed at the temperatures, pressures, r.p.m., and loading conditions that are written down on the log sheet, divided into the amount of gas the dispatcher has calculated going through the station.

Some of you may already be thinking about the possibility of the operator writing down favorable numbers to influence station efficiency. By running engines at a faster r.p.m. than that recorded would make the efficiency number higher. By showing more pockets open than actually are open on the engine would raise the number of the station efficiency.

These same numbers that would increase the station efficiency by erroneous entry would show a smaller developed horsepower than that the engine is actually running. By noting that the developed horsepower was not up to par, a check of the compressor operating curves would show that the unloader pocket was set for the proper loading, especially during the period that the station was expected to give maximum performance.

The number of the line service is shown at the extreme right hand of the page. It is a one-digit code designating which suction line is compressed to a certain discharge line.

For instance line-service one is generally the main-line suction pressure compressed to the main-line discharge pressure. There are stations that have split suction pressure and other stations that have split suction and possibilities of split discharge. It is possible during a day for an engine to operate on more than one-line service.

When this occurs, the conditions applying to that part of the time on a particular line service are tabulated separately. In the lower right-hand corner of the report are shown the average pressures, compression ratio, and average temperatures for each line service. This amounts to the average for this station when there is only one-line service possible at the station.

Also published on the lower part of the daily compressor-station summary are the auxiliary-engine data. For each engine the rated kw, the developed kw, the hours operated, and the oil added are shown. One of the first results made using these data was achieved by adding the developed kw. and checking to see if a smaller number of units could be used to carry the electrical load.

**Monthly compressor-station summary . . .** Proceeding now to the monthly compressor station summary, as shown in Fig. 5, we can see that it is mostly a totaling and averaging of the daily compressor-station summary figures plus some year-to-date figures brought forward. For each engine the listing is made of the hours operated, the hours operated year to date, horsepower-hours operated this month and year to date, oil-consumption rates in quarts per 24 hours for the cylinders, crankcase, and compressor cylinders.

Also listed are total oil used this month and year to date, horse-power-hours per gallon this month and year to date, the average r.p.m., rated horsepower and the developed average horsepower. In these columns basic information is therefore provided for each engine on its usage, loading, and oil consumption.

On the lower part of the sheet of the monthly compressor-station summary is shown a monthly recap of all the daily compressor-station summary information. In fact, the only data that are different on the monthly report from the daily summary and the auxiliary engine data and the monthly station data are the peak day the auxiliary engines operated and the

TENNESSEE GAS TRANSMISSION CO.

MONTHLY COMPRESSOR STATION SUMMARY

STA. 210 MONTH 02-58

| Engine No. | Hrs. Oper. | Hrs. Yr. to Date | Horse Power Hours: This Month | Horse Power Hours: Yr. to Date | Oil—Quarts per 24 Hrs.: Cyl. | Oil—Quarts per 24 Hrs.: C.C. | Oil—Quarts per 24 Hrs.: Comp. | Total Oil—Qts.: This Mo. | Total Oil—Qts.: Yr. to Date | H.P. Hrs. per Gal.: This Mo. | H.P. Hrs. per Gal.: Yr. to Date | Avg. B.P.M. | Rated H.P. | Devel. Avg. H.P. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 244 | 804 | 289,180 | 842,623 | 1.2 | 9.8 | 3.0 | 143 | 720 | 8,033 | 4,681 | 323 | 1,320 | 1,185 |
| 2A | 473 | 1,105 | 530,746 | 1,162,967 | 1.3 | 40.6 | 3.6 | 595 | 1,716 | 2,369 | 2,711 | 318 | 1,320 | 1,122 |
| 3A | 648 | 1,231 | 701,556 | 1,289,982 | 1.1 | 23.7 | 2.6 | 741 | 1,292 | 3,792 | 3,994 | 317 | 1,320 | 1,083 |
| 4A | 543 | 1,214 | 603,026 | 1,260,558 | 1.2 | 30.9 | 1.5 | 760 | 1,444 | 3,174 | 3,492 | 318 | 1,320 | 1,111 |
| 5A | 617 | 1,205 | 666,362 | 1,225,002 | 1.2 | 20.2 | 2.6 | 618 | 1,228 | 4,299 | 3,990 | 318 | 1,320 | 1,080 |
| 6A | 622 | 1,210 | 674,865 | 1,251,775 | 1.1 | 29.3 | 2.8 | 862 | 1,799 | 3,124 | 2,782 | 317 | 1,320 | 1,085 |
| 7A | 598 | 1,232 | 630,330 | 1,243,501 | 1.4 | 8.0 | 3.3 | 316 | 821 | 7,979 | 6,066 | 316 | 1,320 | 1,054 |
| 8A | 505 | 967 | 573,542 | 1,019,985 | 1.1 | 27.6 | 2.6 | 657 | 1,182 | 3,497 | 3,446 | 320 | 1,320 | 1,136 |
| 9A | 540 | 979 | 573,530 | 1,018,412 | 1.0 | .9 | 5.0 | 155 | 373 | 14,706 | 10,951 | 317 | 1,320 | 1,062 |

AUXILIARY ENGINE DATA

| Engine No. | Rated K.W. | Avg. K.W. | Hours Oper. | Peak Day | Oil—Gals. |
|---|---|---|---|---|---|
| 1A | 280 | 175 | 341 | 8 | 38 |
| 2A | 280 | 184 | 261 | 24 | 7 |
| 3A | 280 | 167 | 50 | 1 | 6 |

MONTHLY STATION DATA

| Total Oil — Gallons: Engines | Aux. | Other | Reclaim | Auxiliary K.H. Hrs. | Station H.P. Hrs. | Avg. Sta. H.P. | % Eff. | Dispatchers Thruput | Calculated Thruput | Averages per Line Service: Suct. Press. | Disch. Press. | Comp. Ratio | Temperatures: In | Temperatures: Disch. | Temperatures: Out | Temperatures: Atm. | Line Service |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,287 | 50 | | | 160,253 | 5,243,137 | 7,802 | 97.77 | 24,628,095 | 25,191,043 | 634 | 767 | 1.20 | 39 | | 65 | 23 | 1 |
| NEW OIL 1,337 | | | | | | | PEAK DAY 7 | 979,429 | 25,191,043 | | | | | | | | |

NEW OIL = ENGINE OIL + AUX. OIL + OTHER OIL — RECLAIM OIL

Fig. 5 Monthly compressor station summary

**MONTHLY SUMMARY** has basic information on engine usage, loading, and oil consumption. Fig. 5.

peak day according to the dispatcher's throughput for the highest amount of gas compressed during the month.

**Compressor-efficiency report . . .** The next computed report to be taken up is the monthly report of compressor efficiencies as shown in Fig. 6. The numbers on this report are identical to those found on the monthly compressor-station summary.

This report simply lists all the stations showing their average efficiency for for the month. The dispatcher's throughput and the calculated throughput figures are printed for information. Should there be a reason to verify the efficiency, it is possible to check back through the dispatcher's records and examine the conditions on which the values of the throughput were arrived at.

A good way to analyze this report is to make comparisons between the current month and the previous months, noting the magnitude of the changes. Any trend downward on any particular station would make it worth while to investigate the cause and if possible get the trend reversed.

**Engine-repair-analysis report . . .** An engine-repair-analysis report, as shown in Fig. 7, is prepared monthly for each compressor station. To produce it the maintenance and repair record sheets are processed monthly. A normal run consists of listing all repairs for a station by repair categories and subcategories in engine-number order. The time spent for each repair is summarized within the subcategories by engine type.

For special studies, comparisons may be made between repairs by engines, engine types, stations, categories, subcategories, and engine manufacturers. It should be possible to determine the most serviceable

TENNESSEE GAS TRANSMISSION CO.

COMPRESSOR EFFICIENCIES

FOR MONTH OF

MAR 58

| Date | Station | Efficiency | Dispatchers Thruput | Calculated Thruput |
|---|---|---|---|---|
| | 1 | 93.92 | 11,020,335 | 11,734,328 |
| | 9 | | | 1,324,994 |
| | 17 | 92.37 | 28,958,533 | 31,349,580 |
| | 25 | 98.86 | 34,466,776 | 34,863,671 |
| | 32 | 90.62 | 34,664,837 | 38,254,828 |
| | 40 | 94.47 | 40,685,907 | 43,065,984 |
| | 47 | 90.45 | 48,225,746 | 53,320,095 |
| | 54 | 89.36 | 47,933,700 | 53,638,466 |
| | 63 | 94.48 | 47,600,562 | 50,384,042 |
| | 71 | 91.59 | 46,964,381 | 51,278,950 |
| | 79 | 92.37 | 46,572,554 | 50,422,172 |
| | 87 | 93.91 | 53,482,677 | 56,953,239 |
| | 96 | 86.84 | 52,319,092 | 60,244,849 |
| | 106 | 89.69 | 50,919,377 | 56,772,274 |
| | 114 | 95.34 | 18,047,247 | 18,930,248 |
| | 200 | 90.52 | 29,730,001 | 32,845,105 |
| | 204 | 93.47 | 29,036,197 | 31,064,428 |
| | 209 | 98.03 | 28,829,190 | 29,408,589 |

Fig. 6.

TENNESSEE GAS TRANSMISSION CO.

ENGINE REPAIR ANALYSIS

| Date | Sta. | Engine Number | Engine Type | Part No. | Quan. | New, Used, or Recond. | Cyl. No. | Coding: Eqt. | Coding: Sub. | Coding: Mfg. | Maint. or Repair Code | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | POWER RINGS-COMPRESSION RINGS | | | | | | | | | |
| 12-31-57 | 823 | 8A | TRA-8 | 849040C | 5 | NEW | 5 | 10-01-19 | | | R | .5 |
| 12-31-57 | 823 | 8A | TRA-8 | 849040C | 6 | NEW | 6 | 10-01-19 | | | R | .5 |
| | | | | | 11* | | | | | | | 1.0* |
| | | | | | 11** | | | | | | | 1.0** |
| | | | POWER RINGS-OIL RINGS | | | | | | | | | |
| 12-31-57 | 823 | 8A | TRA-8 | 148-259E | 2 | NEW | 5 | 10-02-19 | | | R | 3.5 |
| 12-31-57 | 823 | 8A | TRA-8 | 148-259E | 2 | NEW | 6 | 10-02-19 | | | R | .5 |
| 12-30-57 | 823 | 8A | TRA-8 | 148-259E | 2 | NEW | 3 | 10-02-19 | | | R | .5 |
| 12-30-57 | 823 | 8A | TRA-8 | 148-259E | 2 | NEW | 4 | 10-02-19 | | | R | .5 |
| 12-30-57 | 823 | 8A | TRA-8 | 148-259E | 2 | NEW | 3 | 10-02-19 | | | R | .5 |
| 12-30-57 | 823 | 8A | TRA-8 | 148-259E | 2 | NEW | 4 | 10-02-19 | | | R | .5 |
| | | | | | 12* | | | | | | | 6.0* |

Fig. 7.

TENNESSEE GAS TRANSMISSION CO.

ENGINE AVAILABILITY AND DOWNTIME REPORT

STATION 823
MONTH 12-57

| ENGINE NUMBER | ENGINE TYPE | TOTAL CATEGORY DOWN TIME | TOTAL REPAIR DOWN TIME | TOTAL UNAVAILABLE TIME | REPAIR TIME PER MILLION H.P. HOURS | % OPERATED | % AVAILABLE | LOAD FACTOR—% |
|---|---|---|---|---|---|---|---|---|
| 1A | KRA-6 | 15.6 | 15.3 | 15.6 | 25.8 | 68.55 | 97.90 | 88.25 |
| 2A | KRA-6 | 4.3 | 2.3 | 18.3 | 2.8 | 96.37 | 97.54 | 88.00 |
| 3A | KRA-6 | | | | | 97.31 | 100.00 | 89.24 |
| 4A | KRA-6 | 1.8 | 1.8 | 1.8 | 2.1 | 95.97 | 99.76 | 91.46 |
| 5A | KRA-6 | 21.0 | 20.2 | 50.2 | 27.8 | 79.57 | 93.25 | 92.91 |
| 6A | TRA-8 | 17.3 | 17.3 | 49.3 | 19.1 | 85.62 | 93.37 | 98.04 |
| 7A | TRA-8 | 35.7 | 35.5 | 67.5 | 85.4 | 40.46 | 90.93 | 95.22 |
| 8A | TRA-8 | 19.1 | 18.1 | 49.1 | 19.6 | 87.37 | 93.40 | 97.96 |
| 9A | TRA-8 | 10.8 | 10.9 | 29.9 | 12.3 | 83.60 | 95.98 | 98.15 |
| * | KRA-6 | 42.7 | 39.6 | 85.9 | 10.2 | 87.55 | 97.69 | 89.96 |
| * | TRA-8 | 82.9 | 81.8 | 195.8 | 26.1 | 74.26 | 93.42 | 97.66 |
| | | 125.6 | 121.4 | 281.7 | 17.3 | 81.34 | 95.69 | 93.25 |

Fig. 8.

spark plug for a given type of engine simply by comparing quantities used for each manufacturer over a certain length of time. Engines using the most pistons would be a worth-while examination, along with the quantity of rings used on the various engines and engine types.

**Engine availability . . .** The last computed report to be taken up is the engine availability and down-time report, shown in Fig. 8. This report is shown by stations and for each engine is printed its engine type, the total down time of all categories, total repair down time, the total unavailable time, the repair time per million horsepower-hours, per cent operated, per cent availability, and the load factor.

To make any complete repair analysis for a particular engine part, the per cent load factor would be a big consideration. For instance, the ring wear of an engine running at 98% load factor would be somewhat different from an engine running at the 75% load factor. It is hoped in time to be able to determine the optimum load factor for the best service of such large engine parts as crankshafts, power cylinders, and power pistons.

The big plus factor of electronic-computer reports has been to increase greatly our knowledge of the operation and maintenance of compressor equipment. Information that was previously obtained by sampling is now processed on a daily basis. Monthly reports that used to be verified and balanced by comptometer operators need not be checked after once being processed through the computer system.

**Requirements to be met . . .** One of the rigid requirements of electronic-computed reports is that the source data coming in from the field must be in such form as to be easily key punched. There are series of built-in automatic checking features in the program to detect out of line numbers, but a poorly averaged number may not show up until a visual inspection is made of the reports that are sent back to the field. For instance, an unloader pocket column may have been added wrong, causing a horsepower-operated figure to be somewhat over the horsepower-rated figure on a compressor engine. This type of thing would probably be spotted in the field, and a check would indicate the erroneous source-data number, necessitating a correction to the stored punched cards in the data processing department. There is some difficulty experienced in writing the rules for the operators and repairmen to code the engine repairs properly.

Much research should be given to any system of coding repairs and down time. The more categories and subcategories that your coding can be broken down into, the more your computer reports can tell you. However, the more coding that has to be done by the field maintenance men, the more the chance of errors, causing reruns.

There exist many possibilities for the future operations of the electronic-computed reports. Some day answers may be found for some of the following:

1. Optimum time for renewal of crankshafts after so many horsepower-hours of engine operation.
2. Influence the quantities of items stocked in station warehouses.
3. Determine the optimum location for large expensive compressor parts.
4. Determine the most efficient combination for engines to run at a given station location.
5. Determine the optimum loading conditions for a group of stations on a pipeline.

# API announces changes in viscosity standards

THE American Petroleum Institute is discontinuing its three viscosity standards—Alpha, Beta, and Gamma as of January 1, 1959.

Under sponsorship of the American Society for Testing Materials, Cannon Instrument Co., State College, Pa., will furnish seven new oil standards for viscometer calibration.

The new versions of ASTM Tentative Method D, 445 Kinematic Viscosity, and Standard Method D 88, Saybolt Viscosity, will refer to the new series.

Approximate viscosities of the new standards, available at $15 per pint, f.o.b., State College, are as shown in the following table:

| | Kinematic Viscosity, Centistokes | | | | |
|---|---|---|---|---|---|
| Viscosity oil standard | At —65° F. | At —40° F. | At 100° F. | At 122° F. | At 210° F. |
| S3 | 340 | 86 | 3 | ... | ... |
| S6 | ... | .. | 6 | ... | ... |
| S20 | ... | .. | 20 | ... | ... |
| S60 | ... | .. | 60 | ... | ... |
| S200 | ... | .. | 200 | ... | ... |
| S600 | ... | .. | 600 | 280 | 32 |
| S2000 | ... | .. | 2000 | ... | ... |

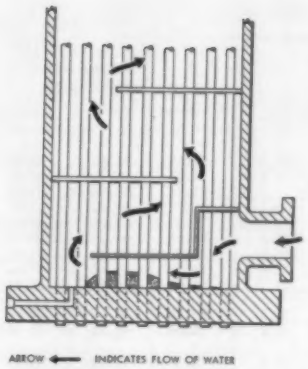
| | Saybolt Viscosity, Seconds | | |
|---|---|---|---|
| | Universal | | Furol |
| Viscosity oil standard | At 100° F. | At 210° F. | At 122° F. |
| S3 | 36 | ... | ... |
| S6 | 46 | ... | ... |
| S20 | 100 | ... | ... |
| S60 | 290 | ... | ... |
| S200 | 970 | ... | ... |
| S600 | .. | 150 | 133 |

REFINING POINTER

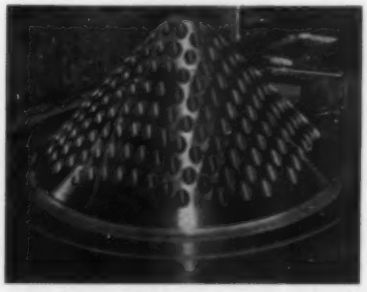
# Conical tube sheet combats corrosion

**Tube sheet is mounted at bottom end of heat exchanger to trap corrosive sludge particles.**

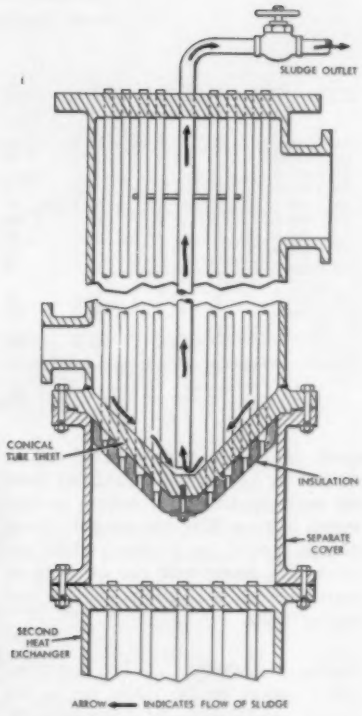
BY LARRY RESEN
Refining Editor




**SLUDGE ACCUMULATED** in vertical exchanger mounted above another exchanger. So . . .



**CONICAL TUBE SHEET** was mounted on bottom end of top exchanger as shown in this . . .




**PLAN VIEW** of final arrangement. Sludge collects at bottom of cone and is removed through sludge outlet line.

A CONICAL tube sheet built into a heat exchanger solves a troublesome sludge corrosion problem at Arabian American Oil Co.'s refinery at Ras Tanura, Saudi Arabia.

The apex of the inverted cone, located at the bottom of a vertical exchanger, traps corrosive sludge particles inherent in the cooling water. Intermittent operation of a sludge blowdown line prevents excessive sludge accumulation. By thus removing the source of corrosion Aramco aims to eliminate tube corrosion and inefficient exchanger operation which occurred with conventional flat tube sheets.

The installation at the refinery consists of a vertical exchanger mounted above another vertical exchanger. Flow through the tubes is in series, while two different cooling mediums are used on the shell side of each exchanger. Difficulty was experienced with the exchanger using cooling water in its operation. In the initial installation a flat tube sheet was used and these tubes failed within 1 year. Failure occurred at the back of the lower tube sheet and was caused by perforation of the tube walls from the shell side. Corrosive sludge elements in the cooling water settled on the lower tube sheet, building up to a depth of 4 in.

Blowdown connections were spaced around the periphery of the bundle, but did not effectively remove the sludge, except right at the opening. Meanwhile, the deposit prevented free circulation of water to the tubes, which overheated. Oxygen concentration cells developed and the tubes corroded rapidly.

A second tube bundle with a flat tube sheet was installed. A stepped baffle was installed in the second unit. Purpose of this was to increase the velocity of the incoming water and thereby circulate the sludge before it had a chance to precipitate. Additional blowdown connections were also provided as a further means of keeping the sludge from settling. This arrangement did not solve the problem.

Aramco, Lummus Co., and Yuba Heat Transfer Division engineers then colaborated on the conical tube sheet as a solution. The tube sheet is mounted on the bottom end of the exchanger and this is then connected to a separate cover secured to the lower exchanger, to provide the series flow as before.

A sludge blowdown line extends downward through the center of the exchanger and ends just above the apex of the conical tube sheet. The tube sheet has a 45° slope, and as particles deposit out they tend to slide down the slope and collect in the apex. By opening the valve in the sludge outlet line, normal pressure on the shell side of the exchanger of several hundred pounds will blow the sludge out this riser. This blowdown operation will not interfere with normal operations, and will serve to keep the area around the tube sheet clean.

**Fabrication . . .** The unorthodox tube sheet was fabricated by Yuba Heat Transfer Division of Yuba Consolidated Industries, Inc., Honesdale, Pa. A rough forging of cyclindrical shape and with a conical interior was first forged. Holes for the tubes were then drilled down as far as possible on the flat side of the forging. Excess metal was then milled away and drilling of tube holes was resumed to reach greater depths than on the initial round. Milling and drilling were continued alternately until the conical tube sheet was completed, and installed in the exchanger.

Steel tubes were then welded to the tube sheet. Since tube side fluid contains abrasive particles, replaceable ferrules were inserted in the tube ends. Abrasive action will be confined to these expendable ferrules. Final step was the inclusion of 4 in. of insulation installed on the outside of the tube sheet flush with the ends of the beveled ferrules.

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Questions on TECHNOLOGY

# Metal contaminants in petroleum

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

**You once discussed metals in oils. Would it be possible to bring this up to date? S.T.M.**

Not much can be added to the general discussion of the answers of:

Nov. 30, 1950, p. 88—Occurrence
Dec. 7, 1950, p. 105—Ash Analyses
Dec. 21, 1950, p. 330—Effect on Refractories
Dec. 28, 1950, p. 83—Effect on $V_2O_5$
Jan. 4, 1951, p. 65—Effect on Steels
Aug. 16, 1951, p. 160—Vanadium Vaporizes

Methods of analyses have been greatly improved but this type of material cannot easily be summarized on this page. However, many more analyses are now available and these are shown in Tables 1-4 herein.

**TABLE 1—AMOUNT OF METALS IN CALIFORNIA PETROLEUMS**

| Name of crude oil— | API | P.p.m. of metals V | Ni | Fe | Cu | Na | Approx. p.p.m. of vanadium in 900°+ F. residue | Ref. |
|---|---|---|---|---|---|---|---|---|
| Arwin | .... | 9.0 | 28.0 | .... | .... | 4.0 | .... | 7 |
| Bradley sands | .... | 134.5 | .... | .... | .... | .... | .... | 3 |
| Coal Oil Canyon | .... | 6.0 | 20.0 | .... | .... | 4.0 | .... | 7 |
| Coles Levee | 36.2 | 11.0 | 31.0 | .... | .... | 4.0 | 61.0 | 7 |
| Cuyama | 34.5 | 10.0 | 32.0 | .... | .... | 31.0 | 67.0 | 7 |
| Cymric | 33.6 | 30.0 | 43.0 | .... | .... | 46.0 | 200.0 | 7 |
| Edison | .... | 6.0 | 11.0 | .... | .... | 51.0 | .... | 7 |
| Helm | *38.0 | 14.0 | 27.0 | .... | .... | 77.0 | 78.0 | 7 |
| Kettleman Hills | 37.3 | 11.0 | 24.0 | .... | .... | 18.0 | 61 | 3 |
| Kettleman | .... | 34.0 | 35.0 | 24 | 0.4 | .... | .... | 13 |
| Las Flores | .... | 106.5 | .... | .... | .... | .... | .... | 3 |
| Lompoc | *20.0 | 37.6 | .... | .... | .... | .... | 102 | 3 |
| Lost Hills | *23.0 | 39.0 | 8.0 | .... | .... | 35.0 | 118 | 7 |
| Nicolai | .... | 246.5 | .... | .... | .... | .... | .... | 3 |
| North Belridge | *14.0 | 23 | 83 | .... | .... | .... | 50 | 14 |
| Orcutt | *23.0 | 162.5 | .... | .... | .... | .... | 490 | 3 |
| Oxnard | *9.0 | 403.5 | .... | .... | .... | .... | 640 | 3 |
| Purisma | .... | 218.5 | .... | .... | .... | .... | .... | 3 |
| Raisin City | *26.0 | 8.0 | 21.0 | .... | .... | 34.0 | 28 | 7 |
| Russell Ranch | *35.0 | 12.0 | 26.0 | .... | .... | 4 | 80 | 7 |
| San Joaquin | *33.0 | 44.8 | .... | .... | .... | .... | 280 | 3 |
| Santa Maria | *15.0 | 223 | 97 | 17 | 0.3 | .... | 475 | 13 |
| Santa Maria | *15.0 | 202 | .... | .... | .... | .... | 430 | 3 |
| Santa Maria | 15.0 | 180 | 106 | .... | .... | 20 | 380 | 7 |
| Santa Maria | *15.0 | 280 | 130 | .... | .... | .... | 595 | 14 |
| Signal Hill | *27.9 | 28 | .... | .... | .... | .... | 108 | 3 |
| Signal Hill | 27.9 | 25 | 57 | .... | .... | 25 | 96 | 7 |
| Ventura Avenue | *31.0 | 25.2 | .... | .... | .... | .... | 126 | 3 |
| Ventura Avenue | 30.3 | 42.0 | 51 | .... | .... | 70 | 210 | 7 |
| Ventura | *31.0 | 49 | 33 | 31 | 1.1 | .... | 245 | 13 |
| Tejon Hills | 24.9 | 64 | 44 | .... | .... | 7 | 213 | 7 |
| Wheeler Ridge | *35.0 | 7 | 1.9 | .... | .... | 2 | 41 | 7 |
| Wilmington | 15-29 | 43 | 61 | .... | .... | 5 | .... | .. |
| Wilmington | *22.0 | 41 | 46 | 28 | 0.6 | .... | 121 | 13 |

*Estimated API gravity used in estimating vanadium in residue.

**TABLE 2—METALS IN TEXAS AND LOUISIANA PETROLEUMS†**

| Name of crude oil— | API | Wt. % ash | P.p.m. of metals V | Ni | Fe | Cu | Na | Approx. p.p.m. of vanadium in. 900°+ F. residue | Ref. |
|---|---|---|---|---|---|---|---|---|---|
| Anahuac, Texas | 34.3 | ..... | 0.2 | 1.1 | .... | .... | .... | .... | 1 |
| Coastal (Heavy) Texas | 29.2 | 0.0073 | 0.94 | 2.3 | 0.77 | .... | 18.0 | .... | 4 |
| Coastal Mixture, Texas | .... | ..... | 0.56 | .... | .... | .... | .... | .... | 3 |
| Coastal Texas | .... | ..... | 0.81 | 1.64 | .... | .... | .... | .... | 12 |
| Conroe, Texas | 37.6 | 0.0007 | 0.008 | trace | 0.81 | .... | 2.18 | 0.16 | 4 |
| East Texas | 37.8 | 0.0036 | 1.2 | 0.88 | 0.51 | .... | 12.3 | 6.4 | 4 |
| East Texas | *38.0 | ..... | 1.05 | 1.69 | .... | .... | .... | 5.6 | 12 |
| East Texas | *38.0 | ..... | 1.2 | 1.7 | 3.2 | 0.4 | .... | 6.4 | 13 |
| Jackson, Texas | .... | ..... | 0.9 | 1.8 | 4.4 | 0.2 | .... | .... | 13 |
| Mirando | *21.0 | ..... | 1.4 | 1.9 | 7.6 | 0.5 | .... | 6.3 | 13 |
| Refugio, Light | *35.0 | ..... | 0.56 | .... | .... | .... | .... | 5.1 | 3 |
| Refugio | 34.5 | 0.0005 | 0.68 | 0.70 | 0.34 | .... | 0.29 | 6.2 | 4 |
| Salt Flat, Texas | 36.5 | 0.0026 | 8.3 | 1.43 | 1.71 | .... | 1.14 | 46.0 | 4 |
| Sweden, Texas | 43.8 | ..... | 0.8 | 0.6 | .... | .... | .... | 44.0 | 1 |
| Talco, Texas | 21.1 | 0.0109 | 8.8 | 2.57 | 2.06 | .... | 18.5 | 19.5 | 4 |
| Talco, Texas | *21.0 | ..... | 6.16 | .... | .... | .... | .... | 14 | 3 |
| Scurry County, Texas | *44.0 | ..... | 0.8 | 1.0 | 3.4 | 0.2 | .... | 8 | 13 |
| Panhandle, West Texas | *41.0 | ..... | 8.4 | .... | .... | .... | .... | 47 | 10 |
| West Texas | *36.0 | ..... | 6.7 | .... | .... | .... | .... | 37 | 10 |
| West Texas | *36.0 | ..... | 6.3 | .... | .... | .... | .... | 35 | 9 |
| West Texas | 24.0 | ..... | 11.8 | 3.8 | .... | .... | .... | 44 | 1 |
| West Texas (same sample) | 24.0 | ..... | 8.5 | 4.2 | .... | .... | .... | 31 | 1 |
| West Texas (Imogene) | 31.1 | 0.0066 | 8.5 | 1.73 | 0.88 | .... | 16.2 | 40 | 4 |
| West Texas | *34.0 | ..... | 8.96 | .... | .... | .... | .... | 47 | 3 |
| West Texas | *34.0 | ..... | 7.9 | 4.8 | 5.1 | 0.4 | .... | 42 | 13 |
| Yates-Pecos, Texas | 29.3 | 0.0022 | 7.8 | 2.6 | 0.11 | .... | 0.67 | 34 | 4 |
| Louisiana | .... | .... | 0.208 | .... | .... | .... | .... | .... | 9 |
| Central Louisiana | 40.6 | 0.0008 | 0.47 | 0.43 | 0.39 | .... | 2.56 | .... | 4 |
| Heidelberg-Eucutta, Mississippi | 22.5 | 0.0319 | 15.35 | 6.02 | 1.78 | .... | 38.6 | 37 | 4 |
| North Louisiana | 39.8 | 0.0044 | 1.06 | 0.59 | 1.02 | .... | 15.2 | .... | 4 |
| Mississippi-Louisiana | 39.1 | 0.0011 | 0.062 | 0.086 | 0.208 | .... | 5.04 | .... | 4 |
| Olla, Louisiana | 29.9 | 0.0100 | trace | 5.65 | 0.70 | .... | 26.40 | .... | 4 |
| South Louisiana | 25.5 | ..... | 0.1 | 0.9 | .... | .... | .... | .... | 1 |
| South Louisiana | 37.7 | 0.0010 | 0.28 | 1.35 | 1.105 | .... | 0.68 | .... | 4 |
| Southwest Louisiana | 36.8 | 0.0005 | 0.084 | 0.165 | 1.015 | .... | 0.50 | .... | 4 |
| Schuler, Arkansas | *33.0 | 0.0410 | 15.2 | 10.2 | .... | 1.43 | .... | .... | 8 |
| Stevens-Smart, Arkansas | *30.0 | 0.0040 | 1.74 | 2.16 | .... | 0.34 | .... | .... | 8 |

*Estimated API gravities used in estimating vanadium in residue. †Also a few Arkansas and Mississippi petroleums.

**TABLE 3—AMOUNT OF METALS IN MISCELLANEOUS U. S. PETROLEUMS**

| Name of crude oil— | API | Wt. % ash | P.p.m. of metals V | Ni | Fe | Cu | Na | Approx. p.p.m. of vanadium in 900°+ F. residue | Ref. |
|---|---|---|---|---|---|---|---|---|---|
| Big Horn mix, Wyoming | 28.7 | 0.0044 | 15.97 | 3.60 | 0.80 | ... | 0.98 | 64 | 4 |
| Big Wall, Montana | .... | 0.012 | 24.0 | 13.2 | .... | 0.12 | .... | .... | 8 |
| Brewster, Kansas | .... | 0.002 | 2.6 | 1.68 | .... | 0.32 | .... | .... | 8 |
| Coffeyville, Kansas | .... | 0.002 | 3.2 | 1.00 | .... | 0.04 | .... | .... | 8 |
| Elk Basin, Wyoming | *31.0 | 0.010 | 38.0 | 9.2 | .... | 0.16 | .... | 200 | 8 |
| Gramps, Colorado (2 samples) | *31.0 | 0.001 | 0.4-0.96 | 0.76-1.6 | .... | 0.026 | .... | 3.7 | 8 |
| Grass Creek, Wyoming | *25.0 | 0.038 | 106.0 | 28.9 | .... | 0.38 | .... | 365 | 8 |
| Half Moon, Wyoming | .... | 0.058 | 98.6 | 27.8 | .... | 1.51 | .... | .... | 8 |
| Half Moon, Wyoming | .... | 0.023 | 50.6 | 0.23 | .... | 0.23 | .... | .... | 8 |
| Hamilton Dome, Wyoming | *20.0 | 0.038 | 106.3 | 24.3 | .... | 0.38 | .... | 280 | 8 |
| Hamilton Dome, Wyoming | *26.0 | 0.012 | 55.2 | 9.1 | .... | 0.19 | .... | 197 | 8 |
| Illinois-Indiana | 36.9 | 0.0075 | 3.82 | 1.36 | 1.15 | .... | 15.9 | 19 | 4 |
| Iola, Kansas | *19.0 | 0.130 | 15.6 | 8.97 | .... | 1.3 | .... | 39 | 8 |
| Kansas | .... | .... | 20.8 | 5.8 | 5.8 | 0.4 | .... | .... | 13 |
| Kendrick, Oklahoma | .... | 0.001 | 0.84 | 0.22 | .... | 1.3 | .... | .... | 8 |
| Lafoon, Oklahoma | .... | 0.022 | 44.0 | 20.2 | .... | 0.176 | .... | .... | 8 |
| Louden, Illinois | 33.2 | 0.0014 | 1.22 | 0.62 | 0.57 | .... | 1.73 | 5.8 | 4 |
| Louden, Illinois | .... | .... | 0.56 | .... | .... | .... | .... | .... | 3 |
| Lost Soldier, Wyoming | *34.0 | (†) | 0.56 | 0.72 | .... | 0.026 | .... | 3.1 | 8 |
| Mid-Continent | .... | .... | 7.9 | 4.2 | 3.8 | 0.3 | .... | .... | 13 |
| Oklahoma-Kansas | 35.9 | 0.0049 | 2.99 | 0.77 | 0.34 | .... | 12.1 | 18.0 | 4 |
| Oregon Basin, Wyoming | *22.0 | 0.015 | 60.0 | 11.4 | .... | 0.045 | .... | 171 | 8 |
| Oregon Basin, Wyoming | *22.0 | 0.035 | 77.0 | 22.4 | .... | 0.105 | .... | 220 | 8 |
| Oregon Basin, Wyoming | *22.0 | 0.018 | 72.0 | 14.7 | .... | 0.40 | .... | 206 | 8 |
| Roosevelt, Utah | .... | 0.004 | 0.164 | 3.04 | .... | 0.052 | .... | .... | 8 |
| Tatums, Oklahoma | *22.0 | .... | 110.0 | 55.0 | .... | .... | .... | 268 | 14 |
| Table Mesa, New Mexico | *60.0 | 0.003 | 0.003 | 0.027 | .... | 1.68 | .... | 0.6 | 8 |

*Estimated API gravity used in estimating vanadium in residue. †Under 0.001.

The last column in each table shows the approximate amount of vanadium that would be present in the material that boils above 900° F. Most metal compounds do boil above 900° F., and probably higher than 1,050° F. Thus in the preparation of catalytic cracking stock, entrainment of metallic contaminants from the residue can be troublesome even though the crude oil contains what appears to be only a small amount of contaminant. It is not possible to obtain accurate distillation data to 1,100° F., but note the general situation:

| | Approx. % above 1,100° F. | P.p.m. of vanadium—In crude | In residue* |
|---|---|---|---|
| 13° API Bachaquero, Venezuela | 41 | 350 | 855 |
| 15° API Santa Maria, Calif. | 39 | 222 | 570 |
| 31° API Lagomar, Venezuela | 19 | 180 | 947 |
| 30° API Ventura Avenue, Calif. | 5.3 | 34 | 642 |
| 36° API West Texas | 2.0 | 9.5 | 475 |
| 41° API San Joaquin (Venezuela) | †0.2 | 2.4 | †1,200 |

*If all vanadium is found in residue. †Obviously the selection of 0.2 or 0.1 or 0.3 greatly changes the amount of vanadium in the residue.

**TABLE 4—AMOUNT OF METALS IN FOREIGN PETROLEUMS**

| Name of crude oil— | API | P.p.m. of metals V | Ni | Fe | Cu | Na | Approx. p.p.m. of vanadium in 900°+ F. residue | Ref. |
|---|---|---|---|---|---|---|---|---|
| Abqaiq | *38.0 | (†) | .... | .... | .... | .... | 2.3 | 3 |
| Colombian | .... | 101 | .... | .... | .... | .... | .... | 3 |
| Comodoro Rivadavia, Argentina | *29.0 | 1.4 | .... | .... | .... | .... | .... | 6 |
| El Burro, Mexico | .... | 20.7 | .... | .... | .... | .... | .... | 3 |
| El Plan, Mexico | *32.0 | 13.4 | .... | .... | .... | .... | 56.0 | 3 |
| Filisola, Mexico | *22.0 | 62.2 | .... | .... | .... | .... | 144 | 3 |
| Kuwait | 31.4 | 22.5 | 6.6 | 0.33 | 0.02 | 2.23 | 78 | 3 |
| Kuwait | *31.5 | 22.5 | 6.0 | 0.7 | 0.1 | .... | 78 | 13 |
| Leduc, Canada | *40.0 | (†) | .... | .... | .... | .... | 5.6 | 3 |
| Naranjos, Mexico | *21.0 | 40.4 | .... | .... | .... | .... | 90 | 3 |
| Morocco | .... | 0.6 | 0.8 | .... | 0.1 | .... | .... | 13 |
| Panuco, Mexico | *12.0 | 77.4 | .... | .... | .... | .... | 141 | 3 |
| Poza Rica, Mexico | *31.0 | 10.6 | .... | .... | .... | .... | 34 | 3 |
| Redwater, Canada | *34.0 | (†) | .... | .... | .... | .... | 3 | 3 |
| Redwater, Canada | *34.0 | 4.5 | 10.6 | 3.4 | .... | .... | 24 | 13 |
| San Rafael, Argentina | .... | 25.2 | .... | .... | .... | .... | .... | 5 |
| Sierra Lotena, Argentina | .... | 1.79 | .... | .... | .... | .... | .... | 6 |
| Tibu-Petrolea, Colombia | .... | 60.0 | 9.0 | 1.6 | 0.9 | .... | .... | 13 |

*Estimated API gravity used in estimating vanadium in residue. †Under 0.56.

This tabulation explains in part the difficulties that nearly all refiners have in the preparation of feed stock regardless of the crude-oil source that is available to them.

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# How pattern efficiency influences secondary recovery of oil

**A reservoir-engineering study involving fluid injection must be made under these basic premises:**

- **Pattern-sweepout efficiencies must be used in predicting secondary-recovery processes.**
- **The sweepout-pattern efficiency is controlled by the mobilities of the fluids involved.**
- **Much more work is necessary before we can accurately predict sweepout performance in nonuniform reservoirs.**

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A RESERVOIR ENGINEER must answer many questions in performing his job. Probably the most important question is: "How can we get the most oil for the least expense in a given reservoir?"

This is a difficult question, for the reservoir engineer must choose between natural depletion and one of the many secondary recovery schemes. He must predict the amount of oil to be recovered for all of the alternatives before he can choose the method best suited for any specific reservoir.

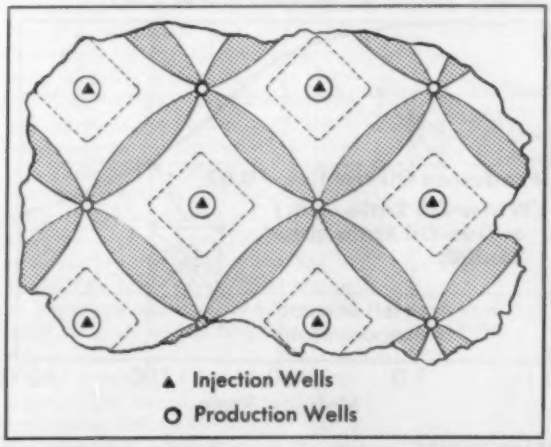
This paper, prepared and delivered by Atlantic Refining Co. personnel for the University of Texas Petroleum Engineering Department, covers an important variable in reservoir injection operations.

In secondary recovery, a fluid such as gas or water is forced into the producing formation to flush the oil from the rock toward the producing wells. To predict the recovery we must know how much of the oil is flushed from the reservoir rock by the injected fluid. This is usually called the "displacement efficiency." Normally it is measured by displacing oil from samples of the reservoir rock by the fluid in question.

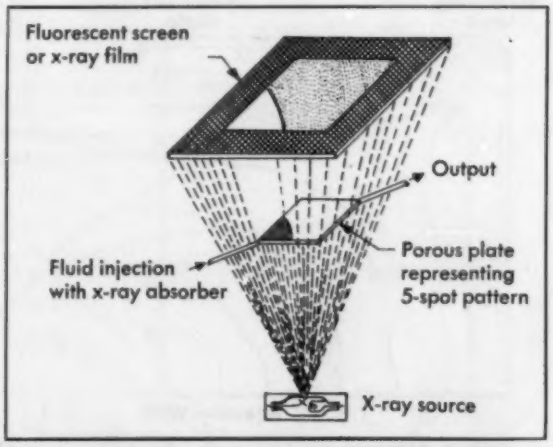
This, however, is only half of the information needed to calculate the expected recovery. In addition to knowing what the displacement efficiency will be, we must be able to predict the fraction of the reservoir which will be invaded by the injected fluid. Only by combining these two factors can we calculate the oil production to be expected in a secondary recovery project. It is obvious that a nonhomogeneous reservoir—such as one having strata of different permeability—will not be invaded evenly or completely by the injected fluid. It is not so obvious that large areas of a homogeneous reservoir can remain untouched by injected fluids.

**Fluid advance . . .** To illustrate this lack of complete areal invasion, Fig. 1 shows three stages in the advance of a fluid in a five-spot system. This simplified example is for a case in which the oil flowing towards the well and the injected fluid have the same viscosities and effective permeabilities. When the fluid first leaves the injection well, it flows equally in all directions.

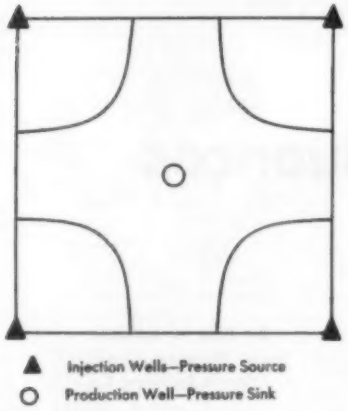
Thus, early in the injection history, the leading edge of the injected fluid advances in a circular pattern. Later, this leading edge becomes influenced by the pressure sink at the producing



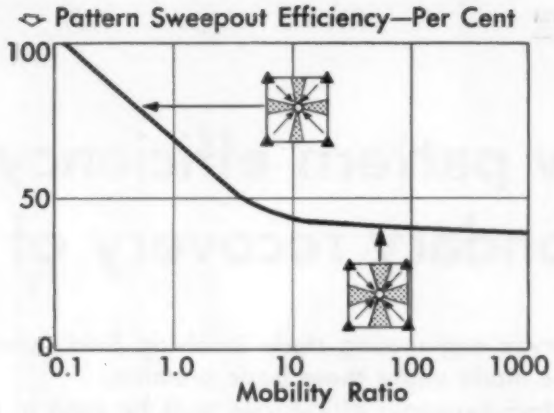

**INFLUENCE** of the pressure sink (production well) is illustrated in the last two of the three stages of flood advance in a five-spot system. Fig. 1.




**X-RAY APPARATUS** for studying pattern sweepout efficiency. Injected fluid contains an X-ray absorbent, so that the path of the fluid will show up on the screen or film. Fig. 2.




**WHEN** fluid mobilities are equal, the production well and adjacent injection wells exert equal influence on the flood front, and cusping results. Fig. 3.




**AT BREAKTHROUGH,** pattern sweepout efficiency is greatest at low mobility ratios. Fig. 4.

wells and the part of the leading edge nearest each producing well begins to cusp.

At the same time, the advance of the injected fluid toward adjacent injecting wells is slowed because of the interference of the flow lines with those of adjoining patterns. These influences eventually cause the injected fluid to reach the producing well as a pointed projection while some areas of the reservoir remain full of oil.

The shape of the front at the time of breakthrough is shown by the heavy line in Fig. 1. The shaded areas show the part of the system not invaded by injected fluid at this time. Although a part of this remaining area can be contacted by continuing the injection, the oil production rate will drop, and the system will gradually become uneconomic to operate.

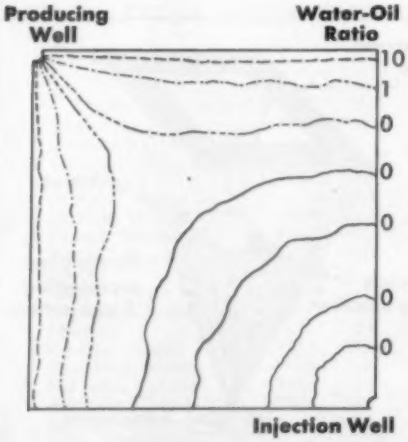
**System too simple . . .** For many years our only knowledge of pattern-sweepout efficiencies came from analyzing simple systems like the one just discussed. It was assumed that the lines of constant pressure (isopotential lines, which fix the lines of flow and the pressure gradients) did not change as the leading edge of the injected fluid traveled through the reservoir. One example of this special case is where the fluid viscosities and the effective permeabilities are the same. With this assumption, it was possible to calculate the pattern-sweepout efficiency for systems of simple geometry.

It was also possible to model this system by using the analogy between fluid flow in a porous medium and the flow of electric current through a resistance bed (potentiometric models) or the flow of ions through a solution (electrolytic models). From this we got values such as the classic 72% pattern-sweepout efficiency for a five-spot injection system.

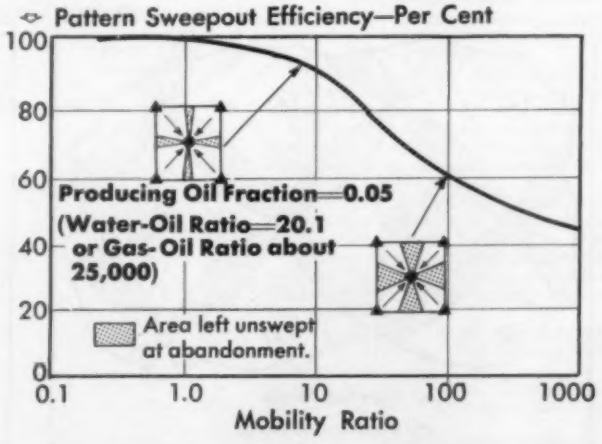
We knew that the isopotential lines change continuously during most injection operations, and that the pattern-sweepout efficiencies could be greater or smaller than 72% in a five-spot system. The change in the isopotential lines is a function of the mobilities of the fluids flowing through the reservoir.

The mobility of a fluid is defined as the effective permeability of the rock to that fluid divided by the viscosity of the fluid. Mobility can be considered as a measure of the ease with which a fluid can flow. From Darcy's law mobility could be expressed as the linear velocity of the fluid at a pressure gradient of 1 atm. per cm.

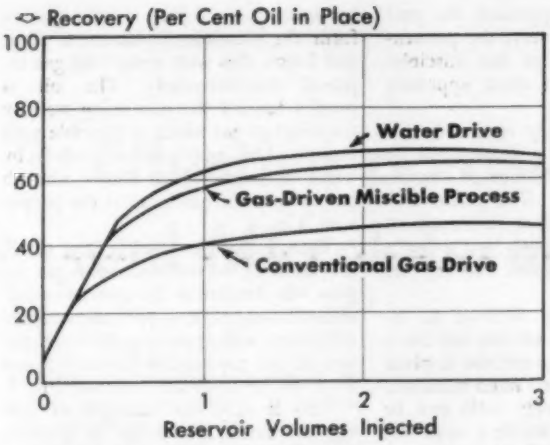
**Consider fluid mobility . . .** We can show the effect of fluid mobilities on



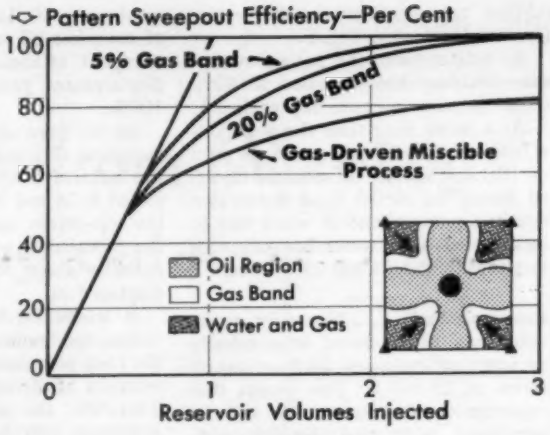

**SWEEPOUT PATTERN** changes as the flood front approaches the production well at mobility ratio of 1.0 Efficiency continues to increase after water breakthrough. Fig. 5.




**AT ABANDONMENT,** pattern efficiency is at a maximum with low mobility ratios. (Compare with Fig. 4.) Fig. 6.




**IGNORING ECONOMIC FACTORS,** recoveries by water drive and gas-driven miscible process are almost identical. Fig. 7.




**EFFICIENCY** of a gas-driven miscible process can be improved by injection of gas and water simultaneously after a gas band has been formed. Fig. 8.

pattern-sweepout efficiencies by considering some extreme cases. In an element of a five-spot injection system when the leading edge of the injected fluid is about halfway between the injection and the producing well, the radial flow out from the injection well (pressure source) tries to keep the advancing front circular in shape while the radial flow into the producing well (pressure sink) tries to pull the nearest point on the front out into a long cusp. When the mobilities are equal, both wells exert an equal influence on the shape of the front, and it begins to cusp. This leads to a pattern sweepout efficiency of 72%. Fig. 3.

If, however, the mobility of the injected fluid is much lower than that of the reservoir fluid, most of the pressure drop will occur around the injection well. The influence of the pressure source on the front will be much greater than that of the pressure sink. Thus the advancing front will not cusp until it is very close to the producing well and the pattern-sweepout efficiency will be higher. Conversely, if the injected-fluid mobility is much higher than the reservoir-fluid mobility, the pressure sink will dominate the system and the pattern-sweepout efficiency will be low.

A mathematical analysis of pattern-sweepout efficiency for unequal mobilities is quite difficult and the electric-current-analogy models are limited to nearly equal mobility studies. We decided to scale down the reservoir to laboratory size and operate it with fluids properly scaled from the reservoir fluids.

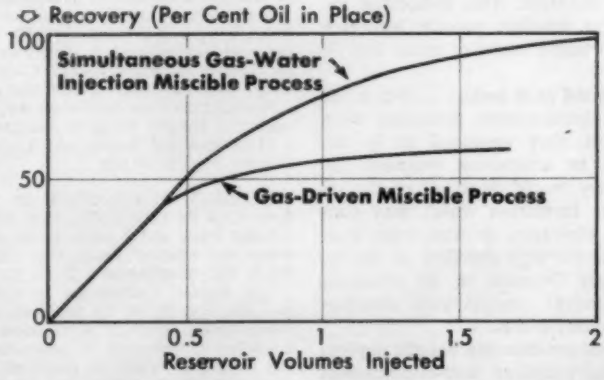
This principle of building and operating scale models is used in many engineering fields. Thus, if we take a small piece of porous medium and scale its geometry to that of the reservoir (or reservoir element) and use fluids having correctly scaled properties, we reproduce—in miniature—the pattern-sweepout efficiency for the reservoir. To see this sweep pattern in the models, we adapted the physician's X-ray equipment. By using a fluid which will absorb X-rays as one of the model fluids, we can use a fluoroscope to trace its movement during a model injection process. Fig. 2.

**How X-ray technique works . . .** The model reservoir element is placed in the X-ray beam while the absorbing fluid is injected. A shadow picture is formed on the fluorescent screen that shows which parts of the model contain the injected fluid. For a permanent record, a sheet of photographic film is used instead of the fluorescent screen. A series of X-ray photographs (called radiographs) taken during a scaled injection process shows the sweepout-pattern efficiency and how it changes during the history of the process.

The pattern-sweepout efficiency most important in reservoir engineering describes the fraction of the reservoir invaded at the time that the injected fluid first reaches the producing well. This is when the oil production rate will start to decline. For a given geometry of the injection system, this pattern-sweepout efficiency is a function of only the ratio of the mobility of the injected fluid to the mobility of the reservoir fluid. Fig. 4.

Usually, water floods will have mobility ratios between 0.5 and 2, low-pressure gas drives will have mobility ratios between 1 and 10, while gas-driven miscible-displacement processes will show mobility ratios of about 100.

Tracings from radiographs made during a modeled water flood of a five-spot injection element show that the pattern-sweepout efficiency continues to increase even after the water reaches the production well. The frontal outline at the time of breakthrough is shown by the dotted line. The sweep efficiency here is 70%. As injection is continued, both fluids are produced from the well with the




**ULTIMATE RECOVERY** can approach 100% in a simultaneous gas-water injection miscible process. Fig. 9.

oil-flow rate declining as the water-flow rate increases. Fig. 5.

At a later time, the pattern-sweepout efficiency has increased to 80% while the water-oil ratio has reached 1.

At a much later time the sweepout efficiency is 95% at a water-oil ratio of 10:1. A record of volumes injected during the model flood shows that nearly 1 part volume of water had to be injected after water breakthrough to attain the additional 25% sweep.

**Economic limit . . .** Normally, reservoirs may be produced economically to water-oil ratios of 20:1 or gas-oil ratios of 25,000:1. This means that injection operations usually will be continued well past breakthrough. Thus, the total oil recovery will be a function of the pattern-sweepout efficiency at these abandonment conditions. For a five-spot injection system, normally, water and low-pressure gas drives will finally sweep nearly all of a five-spot injection system, while miscible gas drives will contact only about 60% of the reservoir. Fig. 6.

Typical unit displacement efficiencies (based on the volume of oil initially in place) are: 65% for water drive, 50% for low-pressure gas drives, and 100% for miscible gas drives.

**How much recovery . . .** The unit displacement efficiency must be multiplied by the fractional reservoir volume to be contacted during a secondary recovery process to determine the amount of oil to be recovered. Thus, for the values given above, a water flood would recover 65% of the oil originally in place; a low-pressure gas drive would recover 50%; and a miscible gas drive would recover 60% of the oil. If we forget any economic factors (such as the availability and cost of water or gas) and look only at the ultimate recoveries, the water drive and the gas-driven miscible displacement show nearly identical production histories. This is because the gas-driven miscible process has such an unfavorable mobility ratio. Fig. 7.

**Not as good as it looks . . .** When the miscible-displacement processes were developed, they appeared to be the ultimate in secondary recovery because they would flush all of the oil from the formation which they contacted. However, it was soon realized that the high mobility of the injected gas (because of its relatively low viscosity) created very unfavorable mobility ratios.

This meant that the benefit derived from the excellent unit-displacement efficiency would be offset by the poor pattern-sweepout efficiencies that would prevail. To approach the goal of complete oil recovery, the pattern-sweepout efficiency of the miscible-displacement process must approach 100%.

As we have already observed, this sweepout efficiency is determined by the ratio of the mobilities of the injected fluid and the oil in place. For the gas-driven miscible displacement the injected gas region will have a mobility about 50 times that for the displaced oil.

It would be very difficult to increase the mobility of the oil since the rock permeability and the in-place viscosity of the oil are fixed numbers. Therefore, the mobility ratio can be improved only by working with the injected material. Again the rock permeability is fixed but we can inject fluids of higher viscosity and thus lower the mobility in this region as long as we do not destroy the miscible displacement of the oil.

A practical way to decrease the mobility of the injected material would be to inject water (viscosity about 1 cp.) instead of gas (viscosity about 0.02 cp.). This, however, would not be a miscible displacement since gas must be the displacing fluid for the process to work. What we can do, however, is to inject a little gas to form the miscible-displacement front and follow this with water and gas injected simultaneously. The oil is pushed toward the producing well by the band of gas which is miscible with the oil. This gas band is pushed by water through which flows enough gas to keep the gas band at the proper size. Fig. 8.

Thus, if the gas band is kept small, the mobility of the water-plus-gas region will determine the pattern-sweepout efficiency. The pattern-sweepout efficiency will approach 100% if the size of the gas band is between 5 and 20% of the reservoir volume. Fig. 9.

This is only one example of how our increased knowledge of pattern-sweepout efficiencies and their causes have helped in production practices. We have studied systems in which part of the reservoir extends beyond the last row of producing wells. Here we found that much of the oil in this "beyond" region will often be recovered in water-flood operations. We have modeled entire reservoirs when no definite injection pattern could be used, and we are studying pattern-sweepout efficiencies for reservoirs containing two or more strata of different permeabilities.

# BOOKS

PLANT OPERATIONS TEST MANUAL. Published by Natural Gasoline Association of America, 421 Kennedy Building, Tulsa 3. 145 pp. $12.

This manual is a collection of over 80 test methods widely used in the control of gas-processing plants. Designed as a convenient, one-stop library of test methods, it brings together into a single volume tests from many widely scattered sources.

The publication was compiled by the association's plant-control committee, headed by K. G. Bottenberg, Phillips Petroleum Co., Bartlesville, Okla. The committee will keep the test methods under constant review, and book holders will automatically receive future revisions and additions as required by changes in methods or plant needs.

Tests included in the manual are reproduced by special arrangement with originating organizations, such as American Society for Testing Materials, Girdler Corp., Fluor Corp., Betz Laboratories, and others.

Designed for plant-laboratory use, the test manual is durably bound in waterproof 8½ x 11-in. loose-leaf binder, and is completely indexed for ease of use.

FEDERAL REGULATION OF NATURAL GAS IN THE UNITED STATES. By Edward Falck and Francis X. Welch. Published by Edward Falck Co., 1625 Eye Street NW, Washington 6. D. C. $2. 100 pp.

The Borden Commission in Canada is presently considering the problems and recommedations which it is to make to the Canadian Government in connection with the form and extent of proposed Federal regulation of the natural-gas pipeline and producing industry in Canada.

As part of its presentation, Westcoast Transmission Co., Ltd., one of the principal natural-gas transmission companies operating in Canada, presented this detailed report on Federal regulation of natural gas in the United States.

Under each chapter topic, a detailed explanation is set forth of the problems encountered by the industry as well as an appraisal of the leading cases in each of these areas. Extensive use is made of footnotes and references to the principal publications, law review articles, statutes, and Commission and court decisions, affecting the industry in recent years.

ANALYSIS OF AVAILABLE DATA ON SECONDARY RECOVERY IN OKLAHOMA, Volume 2. Published by Research Oil Reports, 307 North Broadway, Oklahoma City, 173 pp.

Here is a summary of secondary-recovery projects in the State of Oklahoma. The survey covers the producing zone, well depth, acreage under water flood, monthly production for the past 12 months, where available, and other valuable data. A plat is included which shows the location of each individual water flood. Today in Oklahoma approximately 23% of the state's production comes from water-flood projects, and an additional 7 to 10% from other forms of secondary recovery. This book accentuates the growing importance of these techniques.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

# 3. Effective porosity from MicroLog and Microlaterolog data

BY E. T. GUERRERO
Head, Department of Petroleum Production Engineering, University of Tulsa
and
F. M. STEWART
Staff Engineer, Alex McCoy Associates, Inc.
Engineers and Geologists

(a) OBJECT: To determine effective porosity using MicroLog data.

GIVEN: MicroLog obtained with hydraulic pad (also referred to as contact log and micropetrograph) for well completed in a sand formation. The resistivities of the mud cake and mud filtrate were measured as 1.20 ohm $m^2/m$ and 1.00 ohm $m^2/m$ respectively at the bottom-hole temperature of 150° F. The residual-oil saturation in the flushed zone was estimated to be 20%.

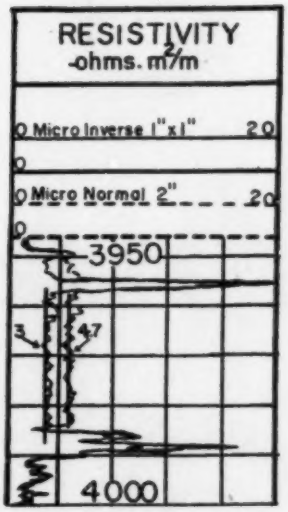
METHOD OF SOLUTION:

$$\phi = \frac{1}{1 - S_{or}} (0.62\, R_{mf}/R_{xo})^{1/2.15} \quad (1)$$

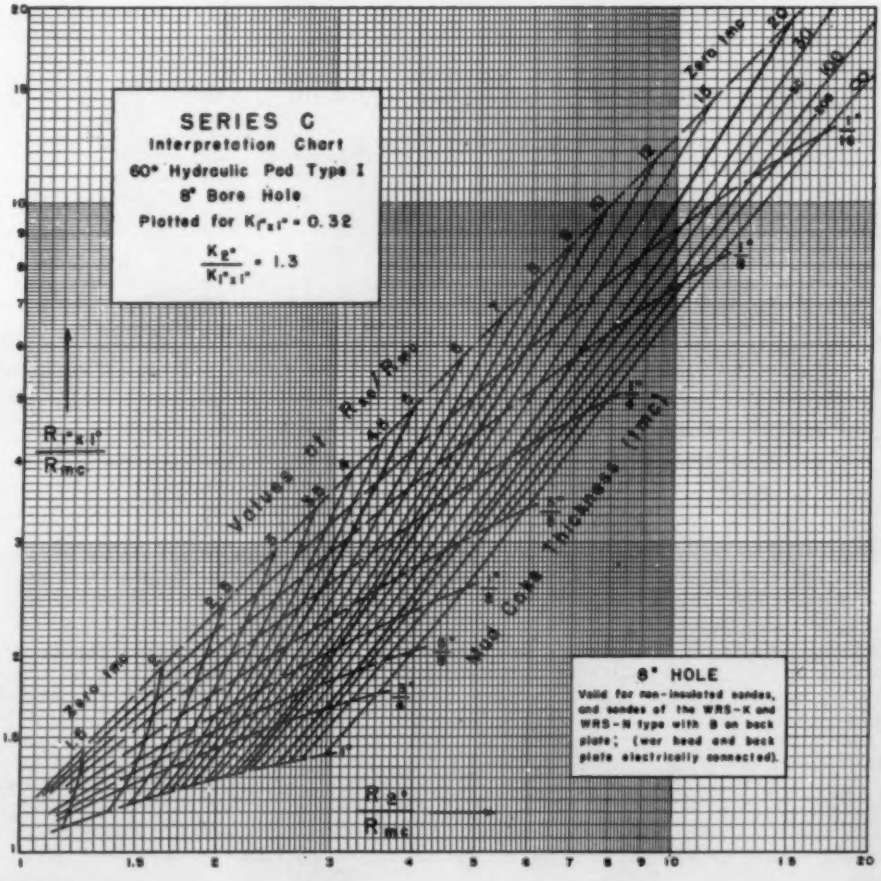
Where

$\phi$ = porosity, fraction
$S_{or}$ = residual-oil saturation in flushed zone
$R_{mf}$ = resistivity of mud filtrate, ohms $m^2/m$
$R_{xo}$ = resistivity of flushed zone, ohm $m^2/m$

(Continued on next page)




**TYPICAL** MicroLog for a sand formation. Fig. 1.


SERIES C
Interpretation Chart
60° Hydraulic Pad Type I
8" Bore Hole
Plotted for Kr'x1" = 0.32
Kg" / Kr'x1" = 1.3
Values of Rxo/Rmf
Mud Cake Thickness (inc)
Zero line
8" HOLE
Valid for non-insulated sondes, and sondes of the WRS-K and WRS-N type with B on back plate; (wor head and back plate electrically connected).

**RELATION** between MicroLog resistivity readings, resistivity of invaded zone, and thickness of mud cake. Reproduced by permission from Schlumberger Well Surveying Corp. Log Interpretation Charts manual, p. C-4. Fig. 2.

SOLUTION:

From Fig. 1

$R_{1''\times 1''} = 3.0$ ohm m²/m = micro-inverse resistivity reading.

$R_{2''} = 4.7$ ohm m²/m = micro normal resistivity reading.

d = 8" = diameter of hole.

$$\frac{R_{1\times 1}}{R_{mc}} = \frac{3.0}{1.2} = 2.5$$

$$\frac{R_2}{R_{mc}} = \frac{4.7}{1.2} = 3.9$$

From Fig. 2

$$\frac{R_{xo}}{R_{mc}} = 17$$

Therefore:

$$R_{xo} = 17 \times R_{mc}$$

$$= 17 \times 1.2$$

$$= 20.4 \text{ ohm m}^2/\text{m}$$

$$\phi = \frac{1}{1-0.2}(0.62 \times 1.0/20.4)^{1/2.15}$$

$$= 0.246$$

or, porosity is 24.6%.

DISCUSSION: The determination of porosity from resistivity measurements depends upon the relationship of formation factor and porosity. This relationship in its most general form is:[1]

$$F = \frac{a}{\phi^m} \qquad (2)$$

Where:

F = resistivity of a rock saturated with a conductive fluid divided by the resistivity of the saturating conductive fluid

a = constant

m = cementation factor

The value of m has been found to vary from 1.3 to 2.3. The form of Equation 2 most used for clean formations (very little or no shale) is as follows:

$$\phi = (0.62/F)^{1/2.15}$$

$$= (0.62\, R_{mf}/R_{xo})^{1/2.15} \qquad (3)$$

Equation 3 applies to formations fully saturated with water. For formations that contain hydrocarbons in addition to water Equation 3 is modified to Equation 1. In order to solve Equation 1, $S_{or}$ must be known. Statistical analysis of flood-pot laboratory tests indicate that $S_{or}$ varies from 0.10 to 0.25, with most clean formations having values of approximately 0.20. Consequently, using a value of 0.20 generally gives good results in clean formations with granular porosity. Greater residual-oil saturations may occur in the cases of low-gravity (viscous) oil and low-permeability formations where the flushing action of the mud filtrate is less efficient.

Fig. 2 used in the solution of this problem is a chart drawn from laboratory measurements. It relates the MicroLog resistivity readings to both the flushed zone resistivity, $R_{xo}$, and the mud cake thickness. As noted, $R_{mc}$ is used as a base. The graph applies for MicroLog measurements made with a hydraulic pad and for 8-in.-diameter holes. Readings can be corrected for application to holes of other sizes. This method of porosity determination gives the best results for formations having porosities greater than 15%. For lower porosities the mud cake becomes thick (greater than ½ in.), the $R_{xo}/R_{mf}$ ratio becomes large (greater than 25) and readings from the chart become less reliable.

Porosity determination using MicroLogs has an advantage over core analysis in that a much larger sample is involved.

(b) OBJECT: To determine effective porosity using Microlaterolog data.

GIVEN: Microlaterolog resistivity measurements and other data for a clean low-porosity sand as follows:

Resistivity from Microlaterolog = 25 ohm m²/m.

Thickness of mud cake from filter-press measurements less than ¼ in.

Estimated residual-oil saturation = 20% of pore volume.

Resistivity of mud filtrate = 0.06 ohm m²/m.

METHOD OF SOLUTION: Equation 1 from (a) applies to this problem.

SOLUTION: It has been established that for thin mud cakes (thicknesses less than ¼ in.) the Microlaterolog reading is a reliable value of the flushed-zone resistivity ($R_{xo}$). Therefore,

$$R_{xo} = R_{MLL} = 25$$

$$R_{mf} = 0.06$$

$$S_{or} = 0.20$$

and

$$\phi = \frac{1}{1-0.20}(0.62 \times 0.06/25)^{1/2.15}$$

$$= 0.06$$

or, porosity is 6.0%.

DISCUSSION: In formations having porosities of 15% or less the survey currents of the MicroLog (also referred to as contact log or micropetrograph) flow mostly in the mud cake and thus reflect little of the character of the formation beyond the mud cake.[2] Under such conditions the MicroLog fails to give reliable information from which the resistivity and porosity of the invaded zone can be determined. In order to obtain reliable values in low-porosity formations, the Microlaterolog was developed. It consists of a micro device involving a focusing system in which the effect of the mud cake on the measurements obtained is reduced. In fact, for mud-cake thicknesses of less than ¼ in. this tool measures directly the resistivity of the invaded zone. For mud-cake thicknesses greater than ¼ in., it is necessary to correct the measurements for deviations caused by the mud cake. This can be done by referring to Microlaterolog departure curves.[3]

This method of effective porosity determination is especially convenient where thin mud cakes prevail. As a rule, wells drilled with high-salinity muds have thin mud cakes. The same is true of wells drilled in hard-rock country.

**References**


1. Martin, Maurice, "With the MicroLog You Can Be Sure," Part 2, The Oil and Gas Journal, October 24, 1955.

2. Tixier, M. P., "MicroLog and Microlaterolog," Fundamentals of Logging, University of Kansas Bookstore, pp. 57-65.

3. Wyllie, M. R. J., The Fundamentals of Electric Log Interpretation, Academic Press, Inc., Second Edition.

4. Schlumberger Well Surveying Corp., Log Interpretation Charts.


## Magnolia will convert TCR unit into Sovaformer

Magnolia Petroleum Co. will convert the Thermofor catalytic reforming unit (TCR) into a Sovaformer at its Beaumont, Tex., refinery.

"This is another example of the obsolescence that oil refiners must deal with," said P. L. Smith, general manager. "Though only a few years old, the TCR process has already been outmoded by the Sovaformer process."

The TCR and the Sovaformer processes are both designed for changing light naphthas into high-octane gasolines by catalytic reforming.

This will be the refinery's second Sovaformer. The first went into service last year. The new unit will have about the same capacity as the present Sovaformer (about 20,000 bbl. per stream day) and will use the same catalyst consisting of nearly 80 tons of platinum-base material.

# Better materials choice means less down time

**The problem of materials . . .**

**The selection of materials of construction in the refinery is a problem that requires constant study. Shutdowns because of material failures are costly.**

**Materials of construction include steel, cast iron, copper, lead, nickel, chromium, and many nonmetallic materials, such as wood, rubber, Teflon, gunite, Karbate, and insulating materials.**

THE BATTERY PRINCIPLE of two unlike metals exposed to a weak acid or a salt solution will set up a condition where a weak electric current will flow and one of the metals will be corroded. This is what happens when strips of copper and zinc are placed in a weak sulfuric acid. These materials form a battery and as the current flows, the zinc is gradually eaten away. We would then say the zinc in this battery has corroded.

The same corrosion takes place with other unlike metals. Problems of this kind are solved by proper choice of the original metals, or by installing a block of a more active metal into the same equipment just for the purpose of being eaten up to protect the equipment metal. Another possible solution is to connect an outside current of electricity to the system and control the loss of metal by controlling the direction of flow of the electric current.

**Erosion . . .** The fluid catalyst in the cat cracker operation cuts away at the unprotected metal parts inside the cracking equipment. This is erosion. Another example is the sand that is sometimes removed with well water, which will cut the pipes and pumps. Erosion is caused by the mechanical action of hard particles on the equipment. The most common solutions to these problems is to use protective coverings or tough alloys.

### Drums

Drum-type vessels are widely used in the oil-refining industry for processing and storage of fluids under many conditions. Some of the more common uses for drums are: surge drums, storage drums, settling drums, filters, water seals and liquid traps.

Surge drums are used as feed drums, reflux and product accumulators, condensate drums, etc., to assure an even flow of liquid to the pumps.

Storage drums are also used to assure a steady supply of the liquid to pumps but have the added use of holding a supply of chemical, water, or oil which is needed in the process.

Settling drums are commonly used as a step in a process to remove materials from the stream being processed. Examples of this are:

1. Desalter on pipe still to settle salt water from crude oil.
2. Caustic settler to remove caustic from caustic-treated oil.
3. Water settler on propane dewaxing process to settle water from propane.
4. Catalyst settler on catalytic cracking units to settle catalyst from the heavy-oil streams.

Drums are also used for other purposes, such as: (1) to hold sand for sand filtering the oil, (2) to hold water to make a water seal, or (3) to serve as a trap to knock out and collect liquid from the suction line feeding compressors.

**Drum construction . . .** Drums are built for use in a particular service. The general divisions of service are classified according to pressure, that is, atmospheric, vacuum, or pressure in excess of atmospheric. Of course, the type of stock and the operating temperature each influence the construction.

Atmospheric-pressure conditions require only that the vessel be strong enough to support itself when full of water, to withstand a reasonable hammer test, and have acceptable joint and nozzle construction. Metal thickness in excess to this minimum required is considered corrosion allowance.

Vacuum within a drum is a special case of pressure-vessel design. To withstand the outside pressure when there is a vacuum inside, a vessel frequently requires reinforcing rings either inside or outside the shell of the vessel. These rings stiffen the shell and prevents its collapsing from the external pressure. When testing a drum for service under a vacuum the minimum test is to subject the vessel to 30 psi. of inside pressure.

Pressure vessel is the broad heading for drums, towers, etc., which are used in operations where pressures are present. The exact metal thickness, joint construction, nozzle construction, testing procedures, etc. for specific temperatures and pressures, are standardized by industry-wide agreement in a published form called, "API-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gases." This code is not only used for designing new vessels but it is also used to determine the allowable working pressures of existing equipment. One of the provisions of the code is that each vessel must withstand a water-test pressure of 1½ times the maximum allowable working pressure of the equipment. Frequently there is extra metal thickness provided in a vessel to provide for losses of metal while in service due to corrosion. When this extra thickness is not available and the service is corrosive, it is then necessary to lower the allowable working pressure or to line it with a protective material, such as a suitable alloy or gunite.

This material taken from process-training-program manual, Baton Rouge, La., refinery of Esso Standard Oil Co.

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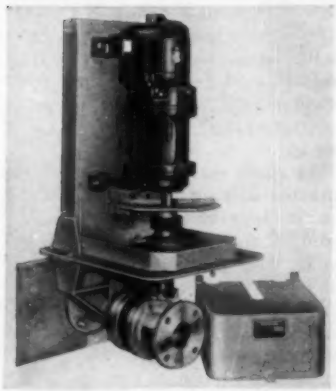
# This week's SHOWCASE features . . .



## Motor-driven liquid valve

. . . closes automatically when power fails. Designed for remote-control operation, the Model MV valve is opened and closed by a built-in motor. The motor is a torque type arranged to operate to a stall in both the open and closed positions so no limit switches are needed.

Features include a floating bronze valve ball, chrome-plated to resist scratching, pitting, and abrasion; and a resilient synthetic-rubber seat that is wiped clean each time the valve opens or closes.

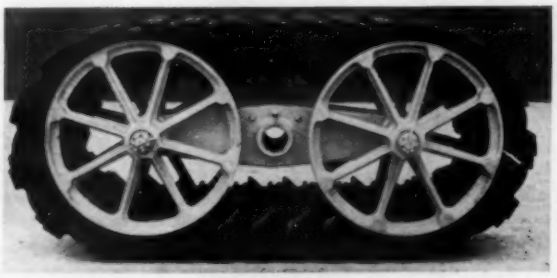
Two valve sizes are available. Model MV-1000 is for 3-in. pipe and Model MV-2000 is for 4-in. pipe. **Write or call: Gemco Inc., P. O. Drawer 3908, Shaker Square Station, Cleveland 20, for details on Model MV valve.**

●

## Transistorized data-processing

. . . system is equipped to scan 100 points at the rate of one point a second. It provides 25 combinations of scaling and zero offset, high or low-alarm limits, and square-root extraction for flow-measurement computations.

Features of the Model 123 system include sealed stepping switches and pinboard programing. **Write or call: Beckman Instruments, Inc., Systems Div., 325 North Muller Avenue, Anaheim, Calif., for details on Model 123 data processing system.**



## Tracks for pipeline equipment

. . . can be installed on new equipment or as field replacement on equipment now in use. Features of the Trac-Wheels include higher track-bridge strength and wear resistance as compared to older types and a one-point lubrication system.

The tracks have been field-tested on pipe-coating kettles and pipe-bending machines and have shown they offer the opportunity for savings in operation of construction equipment.

Only about ½ hour is needed to install the tracks. **Write or call: M. J. Crose Mfg. Co., Inc., Box 3368, Tulsa, for details on Trac-Wheels.**

## T-shaped filter cleans 150 g.p.m.

. . . of JP fuel or water. Pressure ratings go to 5,000 psi. and temperatures to 500° F. The Model 12680 in-line filter will handle gases at rates to 20,000 cu. ft. per minute. The filter element is a stainless-steel, sintered-wire, porous-metal, corrugated-sleeve type. It can be cleaned and reused an indefinite number of times.

The filter head and bowl are of plated carbon steel, stressed for both 3,000 and 5,000-psi. systems with a 4-to-1 safety factor on burst.

Employing one basic design, the filters use an interchangeable element and can be obtained with different

flange sizes, pipe-thread sizes, and ports. Optional is a pressure-differential indicator with a red flag to indicate clogging conditions. Over-all dimensions of the filter range from 6½ in. long by 16⅜ in. deep to 16¼ in. long by 20 7/16 in. deep. **Write or call: Filter Div., Bendix Avintion Corp,. 434 West 12 Mile Road, Madison Heights, Mich., for details on Model 12680 filter.**

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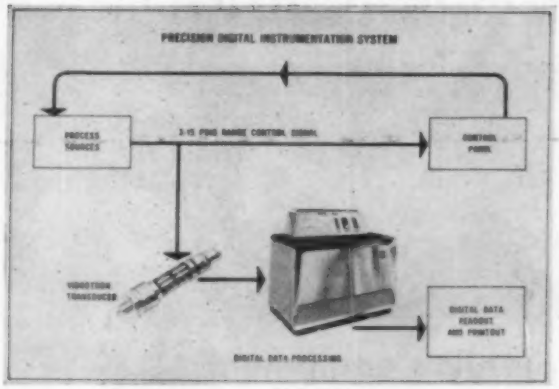
# New Equipment

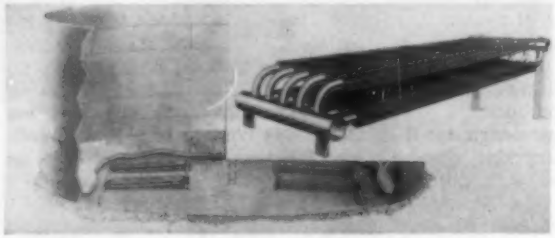



## Digital data-measuring, processing

. . . system accepts any 3-to-15-psi. input and converts it directly into a precise FM frequency output. Called Precision Digital Instrumentation, the system offers a complete and flexible medium for rapid, accurate, centralized process-plant liquid-flow indication, data logging, and readout.

The use of direct conversion and FM techniques in the system promises high reliability. The system offers the chance for reductions in labor, plant operating costs, system maintenance costs, and plant-space needs.

The system is adaptable to pilot plants and to new installations. The Vibrotron transducer used to convert pressure variations into frequency outputs consists essentially of a length of fine wire stretched between a pressure-sensitive diaphragm and an anchor point. The wire is set in motion by an amplifier. Pressure variations change the vibrating frequency of the wire and, consequently, the electrical output frequency and so give the necessary digital information for final processing and readout. **Write or call: BJ Electronics, Borg-Warner Corp., 3300 Newport Boulevard, Santa Ana, Calif., for details on PDI-data-processing system.**



## Platform type of tank heater

. . . for floating-roof tanks has a flat design that allows it to operate in the clearance allowable when the floating roof is in its lowest position. Maximum installed height of the horizontal Thermo-Flo FR-11 heater is 15 in. from the tank bottom. Mounted on short, rigid legs, the heater clears the tank bottom a minimum of 2 in.

This clearance plus convection effects keeps the heater from becoming buried in sediment on the tank bottom and makes tank cleaning easier.

Though horizontal, the heater is pitched slightly so condensate can run off. It is compact enough to be installed through a 20-in.-diameter manway.

Heaters can be connected in series to meet any tank capacity. And they can be moved from one tank to another. The maker's standard heaters are fabricated of mild steel. They are obtainable in chrome alloy or nickel steel. The pipe ends are normally beveled. But flanged or other connections can be had. Each heater is rated at 600 psi. at 600° F., based on a 1/16-in. corrosion allowance. **Write or call: Brown Fintube Co., 300 Huron Street, Elyria, Ohio, for Bulletin 584.**

## Overflow check valve

. . . for manometers and liquid-level gages is designed to prevent blowing out of the indicating liquid. Installed at the top of the instrument, the valve closes instantly at the onset of overpressure and opens automatically when the overpressure is removed.

The check valve has operated without failure in tests through more than 200,000 cycles, with only ordinary care in preventing dirt or contamination from reaching the manometer liquid, the maker reports.

The Series 8838 check valve can be used with all indicating liquids at pressures to 500 psig. It can be obtained with the inlet and outlet threaded to fit most manometer and gage installations. **Write or call: King Engineering Corp., Box 700, Ann Arbor, Mich., for Catalog 2008.**

●

## Six-in. finned heat-transfer tube

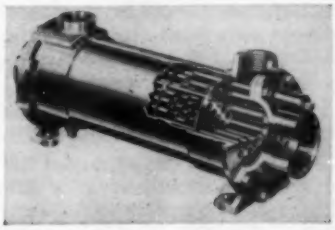
. . . now made for use in convection sections requiring a large tube side-flow area. The fins increase heat-transfer surface up to 10 times bare-tube area.

The finned tube is available to withstand pressures to 5,000 psi. and temperatures to 1,150° F. Fin and tube materials available include steel, copper, aluminum, admiralty, Monel, and Cu-Ni, stainless, and chrome-moly steels.

The precoiled fins are wound under tension into grooves on the tube to obtain a strong mechanical bond. The fins help reduce the number and length of tubes needed in heat-transfer equipment. **Write or call: Griscom-Russell Co., Massillon, Ohio, for details on 6-in. finned tube.**

SHOWCASE . . .

# New Equipment



## Heat exchanger comes in 19 sizes

. . . in one, two, and four-pass designs. The stainless-steel SSCF Series heat exchanger is constructed using mass-production methods to lower costs and so provide an economical heat exchanger for chemical-processing plants.

The unit comes in Type 316 stainless steel for use where fluids may be contaminated by other metals or where all stainless steel is more desirable.

Features include tubes roller-expanded into the tube-sheet holes for a tight fit, transverse baffling, and interchangeable parts.

The heat exchangers are tested at 450 psi. They perform equally well either in a horizontal or vertical position. **Write or call: Ross Heat Exchanger Div., American Standard, Box 2081, Buffalo 5, N. Y., for Bulletin 301.6K1.**

●

## Plastic-lined diaphragm valve

. . . comes with a cast-iron or aluminum body in sizes of ½ through 6 in. with flanged ends. The plastic lining is chemically resistant at temperatures to 300° F.

The valve is compatible with glass, plastic, metallic, and lined piping. Handwheel, quick-opening, air, or electric operators are available. **Write or call: Hills-McCanna Co., Products Div., 4607 Touhy Avenue, Chicago 46, for Bulletin 114.**

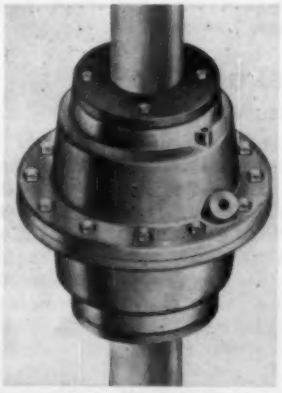
## Meter shows if flow exists

. . . in ¼-in. lines. The miniature flowmeter can be useful where a simple metering device is needed to show if flow is taking place and to meter the quantity flowing. Flow rate is measured by the movement of a variable-position orifice. It is clearly visible through an opening sealed with a high-pressure glass tube.

An adjacent scale is calibrated in units of 0 to 10. With a calibration chart which comes with the Cat. 300 meter, flow rate is easily determined. To obtain desired flow, just adjust a hand valve so the orifice is opposite the proper rate on the scale.

Maximum working pressure of the meter is 100 psi. Various capacities are available. They range from ¼ to 4 g.p.m. The meter should prove handy for determining the flow rate of lubricating oil to bearings and gears and cooling water to compressors. **Write or call: Henry G. Dietz Co., Inc., 12-16 Astoria Boulevard, Long Island City 2, N. Y., for Bulletin G10.**

●



## Control valve for abrasive slurries

. . . uses plant air or hydraulic pressure to control slurry flow through the valve's venturi orifice. A cast-steel, two-piece housing jackets a full-length, 1-in.-thick, gum rubber or neoprene sleeve liner. The liner is easy to replace.

The Clarkson Model C valve now comes in four sizes from 1½ through 4 in. **Write or call: Clarkson Co., 564 Market Street, San Francisco 4, for details on Model C control valve.**


**ELECTRIC HEATING CENTRIFUGE**
**SIMPLEX TYPE**

Patented
*Model A-4-12-S*

**Rotates and heats according to A.S.T.M. specifications**
**For those preferring a separate Centrifuge and Heater**

Heated samples are placed in the trunnion cups where they remain hot during rotation. Of the same design as the combination unit although smaller, lighter and with less wiring. Operates independently of heater, although cups heat while rotating.

Equipped with three stage rheostat switch. Furnished in A-2, (A-2-S), A-4, (A-4-S), and B-2, (B-2-S) models. For use in cars using either 6 or 12 volt batteries. (Specify voltage when ordering.)

**L-K**
***Pump Valve Company***
**P. O. Box 901 Houston, Texas**

S. E. HUEY & CO.
ENGINEERS & SURVEYORS
OUACHITA BANK BLDG.
MONROE, LA.
SURVEYING & MAPPING
PIPE LINE SURVEYS

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We have the know-how through experience and have Le Roi proven Air Drilling Equipment to meet most requirements—any capacity—pressures up to 1500#—Rental with option of purchase—Sales.
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SHOWCASE . . .

# New Literature

## Corrosion resistance of titanium

. . . alloys proved to be much the same as that of unalloyed titanium, as described in new Technical Report 5423 now available. The tests were held to determine both chemical and galvanic-corrosion properties of commercially pure titanium, a titanium-manganese alloy, a titanium-aluminum-tin alloy, two titanium-copper alloys, and two titanium-aluminum alloys. The tests were conducted in synthetic ocean water, tapwater, 1% sodium hydroxide, 5% ferric chloride, and 5% ammonium sulfate solutions, mineral acids, and 1% oxalic acid. The report describes the methods used in the experiments and presents the results in detail. A bibliography is included. **Write or call: Bureau of Mines, Publications - Distribution Section, 4800 Forbes Avenue, Pittsburgh 13, for Chemical and Galvanic Corrosion Properties of Titanium Alloys, Technical Report 5423.**

## Centrifugal compressors

. . . for refineries and petrochemical plants are described in new four-page Bulletin 165. Two types, both single-stage compressors, are described—Series OM for low-pressure air service and Series OPB for gas applications plus high-pressure air. Capacities range from 1,200 to 80,000 cu. ft. per minute. Input horsepowers range between 10 and 2,500 b.hp. The bulletin gives complete details on casings, bearings, seals, impellers, lubrication system, base plates, and couplings, plus recommended applications. **Write or call: Clark Bros. Co., P.O. Box 560, Olean, N. Y., for Bulletin 165.**

## New flow transducer

. . . specifically designed for measuring single or bidirectional flow, is explained in a new four-page brochure. The transducer, called Mark V, has an unusual operating principle which the brochure points out with a cross-section drawing, a chart, and technical data. The brochure states that Mark V can accurately indicate, record, and/or control the flow of hydraulic and abrasive fluids, slurries, acids, caustics, oils, fuels, and any other fluid that can be safely contained in stainless steel. The brochure includes such details as range, pressure, temperature, frequency response, line sizes, and materials, along with input, output, resistance, and connector type used. **Write or call: Ramapo Instrument Co., 8 First Street, Bloomingdale, N. J., for Mark V brochure.**

## Stainless-steel welding fittings

. . . and flanges are detailed in new 56-page Catalog TT600. It consists of updated technical data for allowable S-values, allowable working pressures of fittings, pressure-temperature rating of flanges, and corrosion resistance. The catalog includes applications for stainless-steel and nonferrous alloy fittings and flanges. **Write or call: Tube Turns division of Chemetron Corp., 222 East Broadway, Louisville 1, for Catalog TT600.**

## Stainless-steel valves

. . . with replaceable Teflon disks or seats, are detailed in new Bulletin 11. It describes globe, Y, needle, and plug-gate valve designs, as well as other valves with complete jacketing. The bulletin includes data and application information. A similar publication, Bulletin 7, gives information on stainless-steel valves for corrosive services. It provides data on standards, methods of rating, construction materials, and alloy compositions. The bulletin includes design details, illustrates 36 basic valves, and describes 40 of their variations. **Write or call: Alloy Steel Products Co., Inc., 1340 Elizabeth Avenue, Linden, N. J., for Bulletins 7 and/or 11.**

## Guide to ASME boiler, pressure-vessel code

. . . is now available as a handy 17-by-11-in. wall chart. The chart shows some of the types of pressure-vessel construction provided for under Section 8 of the ASME code. It also furnishes direct references to code rules that apply to these construction features. As an example, circumferential joints are illustrated along with the suggestion to refer to code rules UW-34 and UW-35 for a full discussion of such joints. **Write or call: Missouri Boiler & Tank Co., 2211 Papin Street, St. Louis 3, for ASME Boiler and Pressure Vessel Code (Section 8) wall chart.**

## Oil-marketing hose

. . . reference catalog describes and illustrates types of hose used to conduct petroleum products from the refinery to dealers and consumers. The catalog includes the following hose types: sea, dock, barge-loading, oil-suction, discharge, tank-wagon, tank-car, and truck, gasoline-pump, gasoline-fuel oil, and farm-pump. The catalog also describes three styles of butane-propane hose, plus a butane-vapor hose for carburetors. A special section shows available couplings. **Write or call: Acme-Hamilton Mfg. Co., Trenton 3, N. J., for Oil-Marketing Hose Reference Catalog.**

## Fatty nitrogen derivatives

. . . and complete specifications on five groups are outlined in a new bulletin. The characteristics of these cationic chemicals give them wide applications as anticorrosion compounds in crude-oil production. They are also beneficial as petroleum-product additives and in secondary-oil recovery. **Write or call: General Mills' Chemical Div., Kankakee, Ill., for Fatty Nitrogen Derivatives bulletin.**

## Valve information plentiful

. . . in 12 condensed catalog pages covering a complete line of bronze, globe, angle, check, gate, radiator, and specialty valves. Material is listed so that you can quickly find pressure ratings, recommended uses, features, and roughing-in dimensions for each valve in a wide range of sizes. The fully illustrated 8½ by 11-in. loose-leaf pages are arranged with low and standard-pressure valves of each type together for easy reference. **Write or call: Ohio Brass Co., 100 Surrey Road, Mansfield, Ohio, for Valve Condensed Catalog.**

## Time-zone map

. . . showing standard-time zones of the United States and Canada is again offered free upon request. The map can be displayed on a wall or desk top. It's printed in three colors, on 8½ by 11-in. card. The map has been in great demand because of its usefulness to those who make frequent long-distance phone calls. **Write or call: Ohio Seamless Tube division of Copperweld Steel Co., Shelby, Ohio, for Time-Zone Map.**

## Tubing trays and support systems

. . . for single tubing or multitube and trays for all types of cables are illustrated and described in new 78-page Catalog 858. The catalog shows channel side trays, 1½ and 3-in. high, with expanded metal or solid bottoms and ladder type in galvanized steel and aluminum with fittings and accessories. The catalog includes diagrams, installation information, and load charts. **Write or call: P-W Industries, Inc., Duncan & Melrose Streets, Philadelphia 24, for Catalog 858.**

### Tom S. Moughon appointed

. . . project engineer by Brewster Co., Shreveport, manufacturer of oil-field drilling equipment. He will be a special project engineer for the development of new products, as well as supplement the engineering staff on other assignments. Moughom formerly was manager of Unit Rig Co., Inc.'s South Louisiana district.

### Ohio Injector Co. opens

. . . branch warehouses at Houston and Los Angeles to serve distributors of industrial valves in the area from the Gulf Coast through the western states.

The Houston operation will be managed by J. E. Marrin, according to E. G. Blaylock, division sales manager for the Mid Continent and Gulf States division. The Los Angeles facility will be managed by W. E. McComas of Los Angeles, reports Dennis P. Gordon, division sales manager.

### Lars H. Nordenson appointed

Lars H. Nordenson

. . . vice president in charge of foreign operations of Dresser Industries, Inc. The appointment was made by J. B. O'Connor, Dresser president. Nordenson previously was with Liljeholmens Stearinfabriks AB in Sweden; M. W. Kellogg Co. as sales manager in the London and Paris offices; American Cyanamid Co.; and Union Oil of California.

### G. F. Thornhill appointed

. . . as assistant manager of the Rocky Mountain area of Baroid Division, National Lead Co. He will headquarter at Grand Junction, Colo. He was formerly with Grand Mesa Mud Co.

### David Skylar made vice prexy

. . . by Griswold-Eshleman Co. Skylar joined the Cleveland advertising agency in 1949 and has contributed continuously to the growth and improvement of industrial advertising. In making the announcement, Charles Farran, president of the agency, said that Skylar had been the recipient of several national awards for his work in industrial advertising and public relations from such groups as Associated Business Publications, and American Public Relations Association.

### Walworth Co. appoints

John C. Wallace

. . . John C. Wallace vice president and general manager, reports Fred W. Belz, president. Wallace will be in charge of manufacturing, engineering, sales, and research and development. He was formerly vice president, operations.

Wallace, who has been with Walworth since 1957, formerly was with Hunt Spiller Mfg. Corp., Boston; Lima Hamilton Corp; and Bessemer & Lake Erie railroad.

### John Doyle is named

. . . district manager for Welex, Inc., at Winfield, Kans. Formerly Doyle was a field engineer at Winfield. He is a veteran of seven years oil-well service experience and has been with Welex for the past year.

### New executive is welcomed

. . . into BJ Service, a subsidiary of Borg-Warner Corp. A. M. Birnie (right) is congratulated by John B. Merritt, president, upon being named vice president and sales manager of

BJ. Birnie will establish his offices at the Fort Worth headquarters.

Birnie had been executive vice president of Security Engineering Co. since 1951, where he was in charge of field operations. Previously he was general sales manager of Welex, Inc.

### National Supply Co. opens

. . . an oil-field supply store at Summersville, Ky., about 60 miles southeast of Louisville. Viril L. Cunningham, formerly manager of the company's Fairfield, Ill. store, has been appointed manager. The Summersville store is under the jurisdiction of Robert T. Harris, manager of the Illinois district. The new store will serve 17 counties, extending through central Kentucky from the Indiana to the Tennessee borders.

### Clark Bros. Co. appoints

. . . William Dumar and Joseph A. Goodnough sales engineers in the Mid-Continent area which is served by the Tulsa office. Dumar joined Clark in 1950 and has held posts in the service, parts, and engine sales departments.

William Dumar

J. A. Goodnough

Goodnough has been with the company since 1955. He was an application engineer prior to his appointment.

### Bethelem Supply Co. becomes

. . . Supply Division, Bethelem Steel Co., announces A. B. Homer, Bethelem Steel president.

C. R. Zimmerman was named vice president; Christian Seger, Jr. was named assistant vice president and treasurer; and J. F. Eaton was named assistant vice president, manufacturing, Supply Division.

The positions are the same as those held under the old arrangement.

### Two committees established

. . . by Petroleum Equipment Suppliers Assn. One will make a study on directorships. The other will nominate the next association vice president.

The study committee is headed by M. E. Montrose. Members are A. W. McKinney and Mason Jones, Eastern district; Davis D. Bovaird and Grover Kilgore, Mid-Continent and Rocky Mountain district; F. L. Hereford and Elliott A. Johnson, Southwestern district; and Ted Sutter and H. H. Peters, Pacific district.

Chairman of the vice presidential

nominating committee is W. T. Powell. Members are W. D. Wilson, Rainey Elliott, Grover Kilgore, M. E. Montrose, and J. A. Crawford.

### Warren W. Lee appointed

. . . eastern region sales supervisor for systems engineering of Minneapolis-Honeywell Regulator Co.'s Brown Instruments division in Philadelphia. He joined Honeywell in 1950 and served in various capacities prior to his present assignment. He succeeds J. T. Teed.

W. W. Lee

### Personnel shifts are announced

. . . in the Rocky Mountain district by Dowell division of The Dow Chemical Co. E. W. Moore, sales engineer at Casper, Wyo., will be responsible for supervision of services. He has been at Casper since July, 1955 and joined the company in 1951.

Moore will be assisted by Robert G. Trout, service manager, who has been transferred from Gainesville, Tex. Trout has been with Dowell since 1955 and has been a service engineer at Gainesville since June, 1956.

Allan Keeth, who has been station manager at Casper, is being sent to Sterling, Colo., where he will be manager of the company's industrial station. He has been with Dowell since 1949.

### D. L. Rose appointed

. . . water-flood engineer in the production equipment section, general product sales department at Jones & Laughlin Supply Division in Tulsa. Rose joined the company's Atlas Supply Division at Muskogee, Okla. in 1952. Four years later he was transferred to the Tulsa office.

### John A. Bell, Jr. announces

. . . the appointment of C. A. McClelland as special representative for Southwest Supply Co. in Dallas. Bell, of Pittsburgh, is Southwest's president.

McClelland, for many years, was with Gulf Oil Corp. Later he went into the drilling business for himself. In 1930 he joined Reed Roller Bit Co. and toured every oil field in the world for them. McClelland then went with Ideco and, at the time of his resignation from that firm, was sales manager.

### Mario J. Cueto appointed

. . . vice president, exports, of Reed Roller Bit Co., according to John F. Maher, president. Cueto joined Reed in 1940 as a salesman trainee. He has served as special sales representative, export sales, in Buenos Aires; sales division manager, export division; and export sales manager. In 1935 Cueto was with Yacimientos Petroliferos Fiscales, the Argentine government oil monopoly.

Mario J. Cueto

### Southwest Industries, Inc. names

. . . four men to new positions. E. C. (Ned) Broun, Jr. was appointed general sales manager. Before joining Southwest, Broun was vice president of Henderson Drilling Corp., chief petroleum engineer of Highland Oil Co., and petroleum engineer for Humble Oil & Refining Co.

E. C. Broun, Jr.

W. F. Barstow

W. F. Barstow, who was named industrial sales manager, was formerly with Minneapolis-Honeywell Corp., Standard Oil Co. (Ind.), and Gas Atmospheres, Inc., Cleveland.

Carl J. Maki was elected president of Southwest-Barber, Ltd., a Canadian subsidiary. He had been with Phillips Petroleum Co. and Mene Grande Oil Co.

Charles E. Richards, Jr. was named sales engineer in charge of small horsepower packaged compressors. He had been with Pan American Petroleum Corp. and Gulf Interstate Gas Co.

Meanwhile an announcement was made by Guy W. Cheesman, Jr., vice president and general manager, that Southwest is moving into another industrial field—the design and construction of packaged plants to produce and purify inert gases.

### Resident-sales office opened

. . . in Midland, Tex. by Jones & Laughlin Steel Corp. R. E. Schrock, sales representative, and Richard L. Tuck, field engineer, are attached to the new office, which is under the direction of D. M. Griffith, J&L's Houston district sales manager.

### Kobe, Inc. reports

. . . two changes. Carl Brown has been transferred from Los Angeles to Denver where he will set up new headquarters for Kobe's Rocky Mountain sales division, says Ray Elner, hydraulic sales manager. Brown joined Kobe in 1947.

Carl Brown

Ralph Fanthus

Ralph Fanthus, district sales manager, has been moved from Bakersfield, Calif. to Los Angeles and will have charge of California sales activity. He has been with the company 30 years.

### Two sales engineers assigned

. . . positions with Beaird International, Inc. B. D. Cass will work with packaged compressor sales and Murphy Horton will seek to develop the Canadian market for LP-gas equipment and other Beaird general products.

Horton formerly was chief inspector in Beaird's Shreveport plant and Cass has served in the company's compressor sales office in Tulsa since February, 1957.

New permanent headquarters for Beaird have been set up in Calgary, reports Charles W. Haynes, vice president.

### Carson R. Schall transfers

. . . to Maracaibo, Venezuela as foreign sales representative for Reynolds Metals Co. He was a chemical and petroleum market representative in the Dallas office. Schall joined the company in 1953.

### J. T. Jenkins Co. named

. . . as distributor for AiResearch turbocharger kits, according to The Garrett Corp.'s AiResearch Industrial Division. Sales, service, and installation of AiResearch Model T1419 turbocharger kits on Cummins NH series diesel engines will be handled by Jenkins through a territory that includes Washington, Oregon, California, Arizona, New Mexico, Texas, Utah, Nevada, Idaho, Montana, Colorado, and Wyoming. The distributor headquarters in Los Angeles.

# USSR boasts oil target will be hit

**Russia shows sizable gains in all branches of the industry, with more to come. Other Red countries show little progress. Coming next week: The free-world picture in the Journal's annual International Number.**

THERE IS LITTLE DOUBT that Russia will someday pose a threat to free-world oil trade. The question is how soon and how serious will the danger be.

The Russians have regularly beaten their own goals for crude production, and they have voiced confidence that the target of 7 to 8 million barrels daily by 1972 will be easily passed. Two-thirds of the more than 2,230,000 bbl. daily now produced is from fields in the Volga-Ural region. Baku is the next most important area, followed by fields in the North Caucasus and Georgia.

The refining industry is posing a bigger problem than crude production. The Soviets complain of slow plant-construction time, with 5½ years needed from ground breaking to startup for a 120,000-bbl. plant.

Thousands of miles of crude trunk lines are under construction or planned. One system is being built across Siberia to feed refineries to be strung along the route. Construction of gas pipelines also is being speeded. Soviet planners want to build 16,000 miles of new gas lines by 1965.

Because of the comparative ease with which Russia is expanding crude production, the product will undoubtedly play a big part in the country's foreign-trade drive. There is not a surplus of oil, as such, at present. But more quantities of crude are gradually being offered for sale or barter as the strain on the industry eases at home. Exports of crude and products are now about 120,000 bbl. daily, equal to the peak export year in 1932.

**European satellites . . .** Soviet satellites in eastern Europe are nowhere close to matching Russian production gains. The goal for the second-ranking oil country in the communist world, Romania, is a modest 275,000 bbl. daily in 1960, compared with last year's output of 224,000 bbl. daily.

Hungarian production has slipped to less than 14,000 bbl. daily from a peak of almost 44,000 bbl. daily 3 years ago. The decline is due to water encroachment in Nagy Lengyel field, now good for only 1,800 bbl. daily.

Russia has been supplying oil to meet the needs of eastern Europe, some of it coming from Austria in the form of reparations payments. Albania and Bulgaria each produce less than 10,000 bbl. daily. Slipping production in both Poland and Czechoslovakia is less than 4,000 bbl. daily. East German production is negligible.

**Yugoslavia . . .** Output in Yugoslavia, which has stayed free of the Russian yoke, has risen slightly to more than 9,000 bbl. daily. The government thinks it can boost output to 160,000 bbl. daily by 1965, but development depends on finding capital.

**Red China . . .** A 5-year plan started by the communist Chinese this year aims at raising crude production to 120,000 bbl. daily. This year's target has been much smaller, 33,200 bbl. daily, with little more than half of this amount expected from crude. The remainder was to come from oil shale.

**YUGOSLAVIA PRODUCTION**

**Serbia**

| Name of field—Discovery date— | Depth (ft.) | No. of wells—Flowing | No. of wells—Pumping | Production in bbl.—Daily* | Production in bbl.—Cumulative | Gravity °API |
|---|---|---|---|---|---|---|
| Boka, 1955 | .... | .... | .... | .... | .... | 21.0 |
| Jermanovci, 1953 | 3,500 | 40 | .... | .... | .... | |
| Lokve, 1954 | .... | .... | .... | .... | .... | |
| Velika (Gas) | .... | .... | .... | .... | .... | |
| **Croatia** | | | | | | |
| Dugo Selo, 1955 | 3,900 | 13 | .... | .... | .... | 35.0 |
| Klostar, 1954 | 3,900 | .... | .... | 4,000 | .... | |
| Janja Lipa (Gas) | .... | .... | .... | .... | .... | |
| Levinovac, 1956 | .... | .... | .... | .... | .... | |
| Mramor Brod. | .... | 33 | .... | .... | .... | |
| Sumecani, 1955 | .... | 75 | .... | .... | .... | |
| **Slovenia** | | | | | | |
| Filovci, 1956 | 5,500 | 2 | .... | .... | .... | 40.0 |
| Lendava, 1939 | 5,500 | .... | .... | .... | .... | |
| Total | | *200 | .... | †8,633 | 15,149,440 | |

*Estimated. †Average first 6 months.

**YUGOSLAVIA REFINING**
(Barrels per stream day)[1]

| Company—Refinery location—Government: | Crude | Cracking—Thermal | Cracking—Catalytic | Reforming | Other processing |
|---|---|---|---|---|---|
| Bozanska Brod | 7,970 | 3,200 | 3,200 | .... | 6,000 Vacuum |
| Rijeka | 8,830 | | | | 1,250 Lubes |
| Sisak | 10,700 | | | | 1,525 Asphalt |
| Total | [2]27,500 | 3,200 | 3,200 | .... | |

(1) 300 operating days a year. (2) Government plans increasing capacities of all refineries and building fourth plant to bring total throughput to 56,000 bbl. daily by 1962.

# Low Cost Pumping, Day After Day, With Tapered String of X Mayari Rods

Close to five years of economical pumping have been completed with a tapered string of Bethlehem X Mayari Sucker Rods at a well in the Cole Creek Field, near Casper, Wyo.

The 8324-ft well pumps from the Lakota formation some 300 bpd of 37-gravity oil, plus water. The string is made up of 1-in., ⅞-in., and ¾-in. X Mayari Rods.

The Bethlehem X Mayari is ideal for heavy-pumping duty. It is made from a special grade of nickel-chromium steel, and is normalized to obtain uniform mechanical properties. It has a typical yield point of 65,000 psi, and a typical tensile strength of 95,000 psi.

Whatever your pumping conditions may be, Bethlehem has the range of rods and accessories you need. For full information about these products, call your Bethlehem sucker rod distributor.

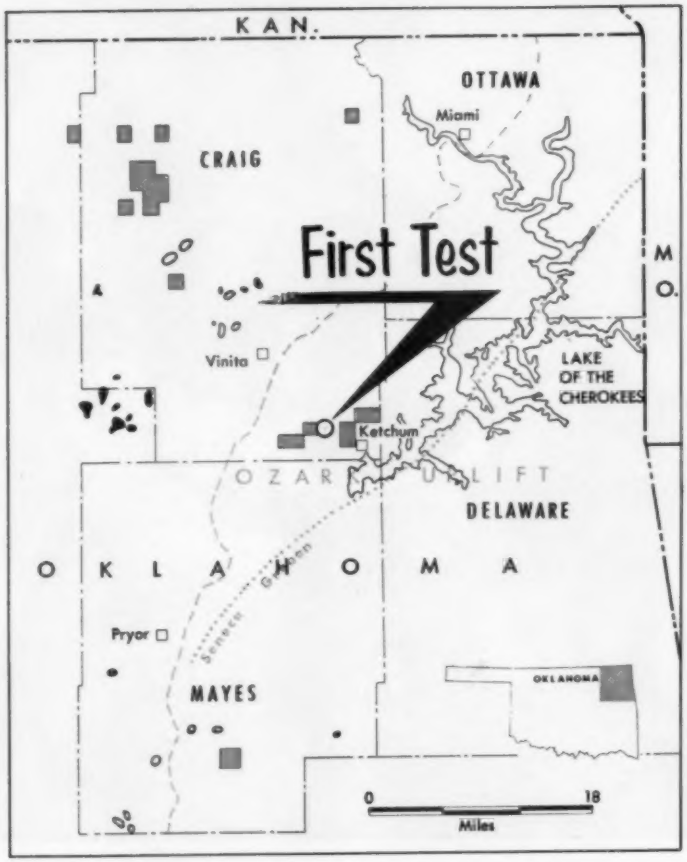
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

*Export Distributor:* Bethlehem Steel Export Corporation

**BETHLEHEM STEEL**

BETHLEHEM STEEL

*For Fast Field Service Call Your Bethlehem Distributor*




**SOONER OIL MEN** are studying the northeastern corner of their state as a possible source of new oil. A lively lease play has enveloped Craig and Mayes counties in 1958, and plans are laid for about 35 wildcats in 1959. The first of these has been staked in southeastern Craig. Shaded squares indicate strong centers of leasing which may soon be drilled in a search for Arbuckle oil.

# Wildcatters move into northeastern Oklahoma

BY FRANK J. GARDNER

THIS HAS BEEN a great year for new plays in old places. Ohio, Kentucky, New York, Pennsylvania, Mississippi, and Oklahoma have all seen unusual new campaigns, and often with excellent results. Application of new techniques in these old producing states is paying off with many new discoveries. They seldom make headlines, but they should not be ignored.

**Two counties . . .** One such campaign is just getting under way in the northeastern corner of Oklahoma. After a heavy lease play during the past few months, the first wildcat has been announced; it is expected to be the opener in a flurry of drilling this winter. The center of interest lies in Craig and Mayes counties.

Since the middle of last summer, an estimated 100,000 acres of land has been leased in these two counties alone. Much of it was on farmout from major companies, but some of it had never been under lease before. The initial program got under way last spring, and the fever mounted during the summer and fall months. Now, the drilling begins.

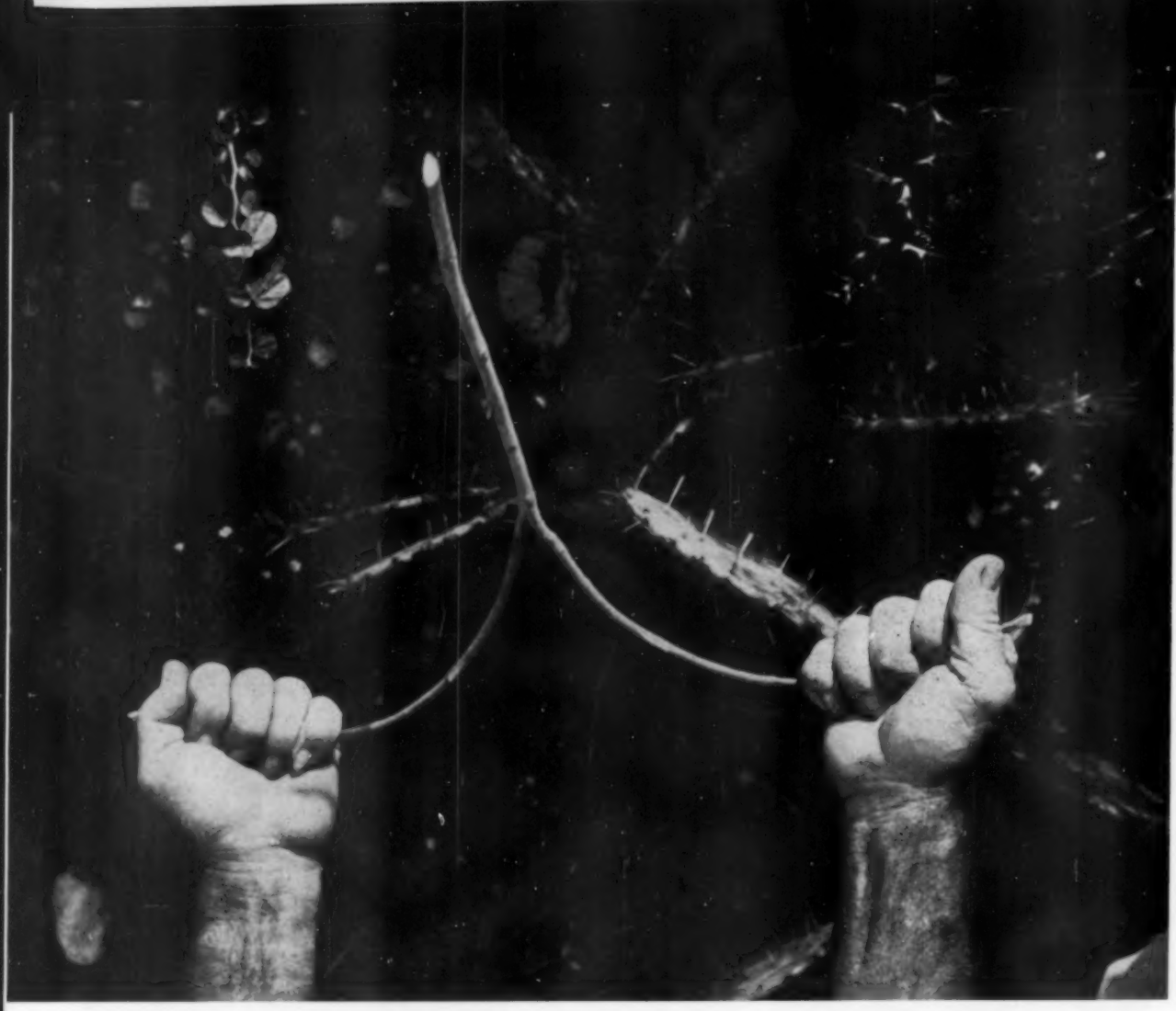
**Have a new objective . . .** The first wildcat to go down will be J. W. Dye and M. O. Henry 1 Ross, in Section 20-24n-21e, Craig County. It will go to granite, expected at about 2,100 ft. This means a complete penetration of the Arbuckle, prime target of future tests in the area. Earlier drilling in this and other parts of northeastern Oklahoma has aimed chiefly at the Mississippian, and few wells have gone deeper than 1,500 or 1,600 ft.

There's plenty to shoot at in this neglected corner, just east of Oklahoma's earliest oil play. It lies on the western edge of the Ozark uplift. Its geology, both surface and subsurface, is very complex. Structural anomalies are plentiful, on the ground and under it and subsurface strat traps should be abundant, especially in the Pennsylvanian section. Other potential pay zones lurk in the Mississippian, Arbuckle, and Cambrian.

**In many types of traps . . .** The key to success is believed to lie in correct interpretation of the Precambrian surface. This is an area of buried granite peaks and ridges. It's an area that has been uplifted, eroded, and resubmerged time and again throughout geologic time. The resulting unconformities could hide many an oil pool. Other strat traps may lie in porosity pinchouts in sands filling the Precambrian valleys, and in the channel or lensing sands of the Pennsylvanian. The region is heavily faulted; this, combined with the possibility of compaction anticlines over the buried granite highs, enhances the outlook for structural traps.

Craig and Mayes counties are the centers of interest at the moment, but if success is met at any of the initial tests there, the play will undoubtedly spread into Ottawa and Delaware counties, and possibly into southwestern Missouri and southeastern Kansas. Independents have lost no time moving into the area. Some core drilling is being done, and no doubt we can expect to see more gravity and magnetics put to work in the near future. Carter Oil Co., a large leaseholder here, conducted 30 crew-weeks of magnetometer work in 1957.

This will be an interesting campaign to watch. If the 35 wildcats already mentioned by various operators for 1959 materialize, Craig and Mayes counties may provide important pools for Oklahoma next year. There is some small scattered oil production in the two counties now (about 6,000 bbl. per year), and exploration dates back to 1904, but this is the first time a systematic study and attack has been applied in this corner.



# Doodlebugs: Facts or frauds?

SURPRISINGLY ENOUGH, the men peddling doodlebugs aren't usually crooks.

Southwest Research Institute studied 100 unorthodox methods of petroleum exploration and found little evidence of outright fraudulent intent. However, 66% of the more than 100 offbeat methods analyzed were of no value.

For a group of five major American petroleum-producing companies, the institute spent 3 years investigating these methods. The purposes of the work were to screen and evaluate various oil-finding methods offered to the industry by independent inventors, to provide the companies with early clues to promising new developments in geophysical prospecting. In addition, Southwest served as intermediary between the companies and the inventors so as to provide an impartial evaluation to the company and free technical counsel to the inventor.

Reprinted from "Tomorrow Through Research"—publication of Southwest Research Institute, San Antonio.

The oil-finding methods encountered were extremely diverse in character, but were arbitrarily divided into three classes: scientific methods, pseudo-scientific methods, and magical methods.

### Scientific Methods

Several experimenters have attempted to correlate the phenomenon of the dependence of the field strength of the ground wave on the local conductivity of the soil with petroleum deposits for several years without clear success.

Other radio techniques have been developed in which the polarization and phase of the received wave are also measured. The patterns observed in the field are repeatable functions of position, but their empirical interpretation is not a simple matter in the absence of an adequate theory.

Attempts have been made to explain the field observations by the reflection of radio waves from deep underground formations, but direct experiments and electromagnetic theory indicate that sufficient penetration of radio waves into sedimentary complexes is not possible. An alternate hypothesis is that all "radio patterns" are caused by near-surface variations in resistivity.

However, it has not, as yet, been shown that the "patterns" are consistently related to oil accumulations, either by the discovery of a mechanism or by adequate, independently verified, empirical field work. The same problems arise with respect to "radioactivity prospecting for oil" as the beta and gamma radiation from the soil vary markedly in intensity from place to place.

A survey of present geochemical practice by the Institute showed that at least one company still offers a geochemical hydrocarbon-sampling and analysis service, that some research is being done, and that at least

one small oil company uses a secret geochemical technique routinely for reconnaissance.

Of the electrical methods evaluated, one involved charging the underground interfaces between chemically different strata between periodic currents and observing the spontaneous discharge. Too little was known about the electrochemistry of rocks, however, to pursue this technique.

A second method employed electromagnetic fields and waves of frequencies which penetrate very deeply into the earth. Although this method was concerned with resistivities which are well understood, evaluation of this method was discontinued after works of others pointed out that electromagnetic reflections from oil reservoirs should not be distinguishable from reflections originating from strata of weaker electrical contrast which are numerous in the earth.

Several variations of the conventional seismic and electrical-resistivity methods were studied. One method receiving vigorous promotion is a directional-resistivity method, employing an electrode in a well, if available. Very few of the variations of technique encountered appeared to be capable of markedly improving the seismic and resistivity methods. The obviously worthwhile improvements studied, including wideband magnetic recording and automatic computation of records, were already well on their way toward general acceptance.

### Pseudoscientific

The majority of pseudoscientific methods involve forces or phenomena — electromagnetic waves, telluric currents, and geochemical surface effects, including radioactivity "patterns," each of which might actually be useful in the search for oil. Some of these methods exhibit obvious flaws of technique such as a lack of adequate background-control data from "normal" areas, with which "anomalies" can be compared.

In pursuit of a quick return, many independent prospectors take fragmentary geophysical data at face value from pseudoscientific practitioners. One such perpetrator, for example, advocated the single-trace seismograph which, he claimed, would indicate oil and water directly, would resolve near-surface horizons tor foundation studies, would be effective to minimum depths of 14,000 ft. and, he contended, was faster and cheaper than conventional methods.

Equally naive was a cathode-ray apparatus said by its inventor to measure a combination of geomagnetic and gravitational forces which he believed are indistinguishable.

### Magical Methods

Magical methods, void of any rational basis, were based on wishful thinking or on subjective, personal sensations and phenomena.

The technique, for instance, by which a man was literally drawn to oil by means of minerals and chemicals taped to his body, was one of the more fantastic.

The sorcery of technical jargon was indicated by the description of a forked brass dowsing-rod attached to miscellaneous radio parts and containers of secret minerals. "Our electronics instrument," the inventor claimed, "receives electrons that radiate from oil and gas formations in the subsurface structure, transmitted by the ultramicronic waves, generated by the rotation of the earth around its axis, which are deflected on leaving the earth by the gravitational attraction of the sun; this force is measured in torque."

The independent oil producer who fell for such gibberish drilled a dry hole located by the proponents of this method.

Magic in modern guise served as the explanation of inventions of many oil-dowsers. The man, for instance, who claimed he could locate oil wells any place in the U. S., regardless of distance, with only a map.

Some believe oil emits characteristic "vibrations," called "electrical impulse waves," "electronic lines of force," "mineral gravity waves," "gamma rays," "atomic radiation," "personal vibrations," etc. which can penetrate unlimited thickness of rock and can be detected by means of radio apparatus or Geiger counters, by means of forces exerted upon dowsing forks, which usually contain radio parts, uranium ore, or secret substance, or by sympathetic vibrations induced in specially treated hand-held pendulums.

One dowser sensitized an ordinary wire coat hanger to oil by adding a safety-razor blade "to cut the lines of force." One man built a machine based on the unsupported magical hypothesis that there is a special sympathetic attraction between oil in the ground and oil in a bottle and the machine was purported to produce a log of petroleum content versus depth!

A particularly grotesque example of magical procedures is provided by the life story of a man who, in 1909, while working in the assay laboratory of a Colorado radium mine, noticed that a bottle of petroleum fluoresced like the ore when illuminated with ultraviolet light, "thus establishing the radium-activity of crude oil." He claimed to have tied a piece of string around a piece of uranium ore from the mine, and held it over a bottle of crude oil, and it started a circular motion from left to right, and then spun violently in an arc over the oil.

Later returning to the Florence oil field, he obtained the same action near a producing well. At a dry hole nearby, he could get no action out of the uranium-ore doodlebug. After 20 years of clandestine experimentation, the man perfected his method; a surveyor's plumb bob was filled with a special mixture of "radium-active" minerals, and inserted into a hole in the ground.

The Geiger tube of a survey meter was held against the buried plumb-bob. High readings were supposed to mean oil. Six wildcats were drilled at locations chosen by this method but all were dry. The inventor confessed: "I am at loss to understand this."

During the 3-year period, the Institute impartially tested the practical results obtained by three dowsers. One employed a pendulum and claimed to be able to tell water from oil in sealed, wrapped bottles. A second employed a pair of divining wands and claimed to be able to trace underground pipelines. The third employed a forked wooden stick and claimed to be able to predict success or failure at newly staked oil prospects—both wildcats and field extensions, before drilling commenced. None of the results were substantially different from what would have been achieved entirely by chance under the circumstances of the various tests.

The Institute's study points out that the outstanding unsolved problem at this time appears to be that of "surface patterns" sometimes detected by radio-activity, electrical, including r.f., or chemical means. "Surface patterns" appear to be faint, impermanent, and far-from-universal attributes of oil fields, if indeed there is any correlation.

Improved means are needed to study the "patterns" attributed to oil in the midst of soil variations of other types. If they can be shown consistently to exist over oil fields, the mechanism and laws of their formation should be determined to permit intelligent exploitation.

Important refinements are constantly being made in the conventional seismic methods. There may also be potentialities as yet unforeseen in new electrical methods, because of the extreme versatility of electricity

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and the ease with which it can be controlled and directed deep into the earth. Recent discoveries, such as nuclear magnetic resonance, indicate that perhaps the greatest hope for a radically improved geophysical prospecting method lies in fundamental physical research.

## Another pool for NW Oklahoma

HARPER COUNTY has a new discovery. Pan American Petroleum Corp. found gas-distillate production at a western Oklahoma wildcat.

Pan American and others 1 Pile Gas Unit, located in Catesby operating unit No. 5, 21-25n-24w, Harper County, recovered gas at the rate of 6.7 M.M.c.f.d. plus an ungaged amount of 51°-gravity distillate on a calculated open-flow potential test.

Recovery was from the Morrow, topped at 7,260 ft. The well was drilled to a total depth of 7,674 ft., plugged back to 7,289 ft. The well is located about 3 miles southeast of Laverne gas field.

Pan American owns 42% interest in the Catesby No. 5 operating unit of 5,760 acres, or nine sections, in area. The 1 Pile is the discovery in this operating unit, which is one of several jointly owned operating units in the immediate area.

## Prolific pool opens in Garfield County

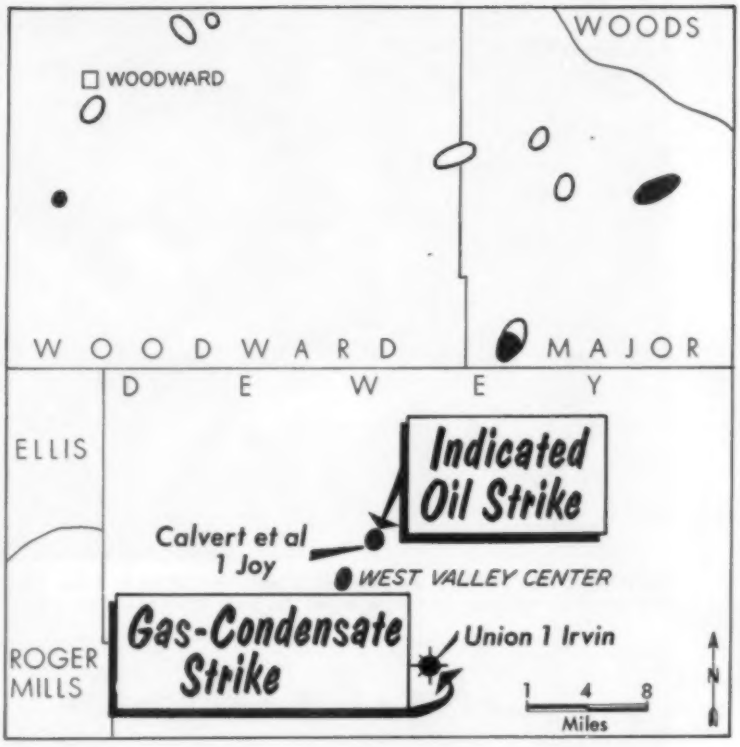
NORTHERN OKLAHOMA has a new oil discovery. Sunray Mid-Continent Oil Co.'s wildcat, the 1 Bertha M. Thompson, has opened a new oil pool in Garfield County. The well, located in C SE NW 15-25n-5w, flowed at the rate of 816 bbl. of oil a day on initial tests through 32/64-in. choke.

The wildcat is producing from the first Wilcox sand. The well is 3½ miles from nearest production which is in Southwest Hunter field.

Pipe was set at 6,459 ft. and perforations made from 6,349-64 ft. opposite the first Wilcox formation. The well flowed 34 bbl. an hour for 3 hours through 32/64-in. choke; then on another 3-hour test, the well flowed at the rate of 5 bbl. of oil an hour through an 8/64-in. choke.

Tubing pressure was 750 lb. and casing pressure 1,150 psi. Oil gravity was 41.4°, corrected.

Sunray has staked location for a 40-acre north offset.




## Near-barren area hits twice

OKLAHOMA'S Dewey County, a one-pool producing area, may have two new fields.

Calvert Drilling C ., King-Stevenson, and Midwest 1 Joy in NE 30-18n-17w, northeast of West Valley Center field, is an indicated Oswego-Pennsylvanian oil strike. Farther south, northwest of Putnam, Union Oil Co. of California has a Springer (?)-Pennsylvanian gas-condensate strike at its 1 Irvin in SE NW 10-16n-17w.

The Calvert et al. well recovered 420 ft. of oil on a drill-stem test of the Oswego at 8,731-8,808 ft. Tests indicated 40 ft. of effective pay. The group of operators hold 3,500 acres in the discovery area.

Union's discovery flowed 4,700 M.c.f.d. of gas on 28/64-in. choke from intervals at 11,211-22 ft. and 11,232-42 ft. plus 15 bbl. of condensate per 1 M.M.c.f.

The discoveries, if successfully completed as producers, could open the second and third pool in this Anadarko County basin. The only producing area in Dewey is West Valley Center.

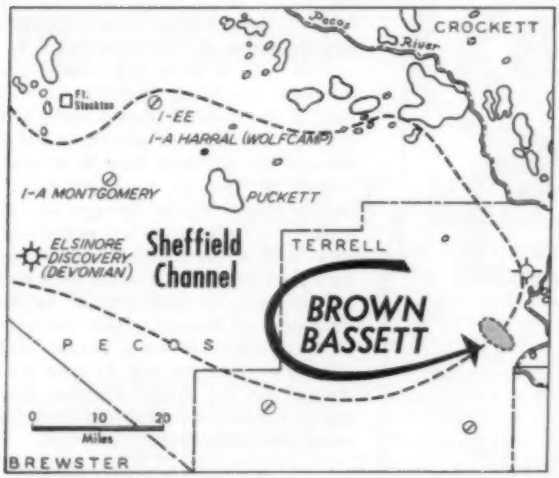
## Big gasser in West Virginia

THE SAND HILL DISCOVERY in Ritchie County, West Virginia, was completed by Hope Natural Gas Co. flowing 5,290 M.c.f.d. of gas from Silurian dolomite. The well, 10160 Leora A. Elliott, flowed through 4-in. opening in 7-in. casing.

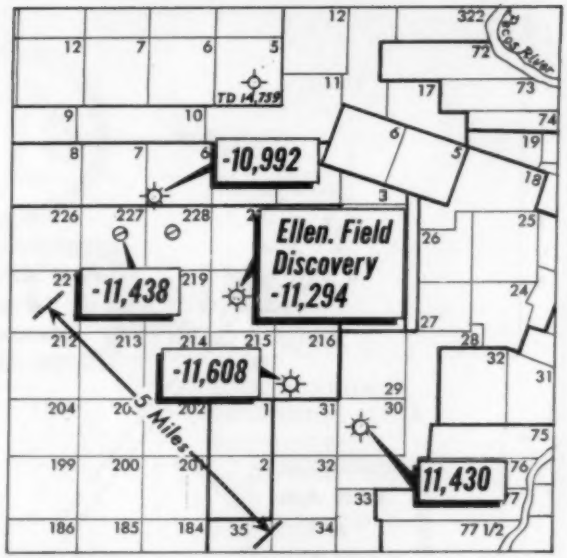
This new gas-pool opener is located on the Burning Springs anticline in western Ritchie County, Marietta Quadrangle, Grant district, 28,690 ft. south of Latitude 39° 20′, 1,275 ft. west of Longitude 81° 15′.

Hope planned to drill to 13,500 ft. in Precambrian, but gas was found in the shallower Silurian, so commercial completion stopped the deeper push.

Hope has staked new location for another proposed basement test in this area located as follows: 10211 A. M. O'Brien on Unit lease of 662.50 acres. One mile southwest of 10160 Elliott, 6,400 ft. southeast of previous basement test: Hope 9634 Power Oil Co. TD 13,331 ft., and about 2,000 ft. due west of Hope test well No. 9300 Powell. Work on road and location is under way and drilling is contemplated soon.




**LOCATION** of Brown-Bassett Ellenburger gas field in Terrell County. Geological position is on the Pandale anticline which separates Val Verde basin from Sheffield channel.




**BROWN-BASSETT FIELD**, showing location of completed wells at this writing. Depths are all subsea datum points on the Ellenburger.

# Brown-Bassett grows; now 5 miles long

TERRELL COUNTY'S big Brown-Bassett gas field last week gained its third Ellenburger completion, and a 1½-mile southeast extension to that pay.

The latest completion is Magnolia Petroleum Co. and Western Natural Gas Co. 2 Banner estate, Section 30, Block 161, GC&SF Survey. Calculated open-flow potential was 29 M.M. c.f.d. of gas, from open hole at 14,-140-14,340 ft.

No. 2 Banner also flowed gas at the rate of 9,500 M.c.f.d. from the Fusselman section, and while drilling, flowed approximately 5 M.M.c.f.d. from the Wolfcamp around 5,100 ft.

Location of this well on the field's southeastern end is about 1 mile south and slightly west of the original gas wells in the area. These shallow wells on the Hoge Ranch were completed in 1931, for around 5 M.M.c.f. At that time they were identified as Pennsylvanian. Operators at 2 Banner said their shallow gas shows were in the same formation as the Hoge wells.

Brown-Bassett field's other pay is the Fusselman. Magnolia and Western's first well, the 1 Brown-Bassett in Section 218, flowed heavily from the Ellenburger at 14,120-14,946 ft. but a blowout and fire prevented completion in that formation. Completion was from the Fusselman section at 12,387-12,446 ft.

Optimism of the ultimate size of Brown-Bassett field is still high but after additional seismic work over the area, there has been some new thinking. A description of the discovery and the field's potential (see The Oil and Gas Journal, August 18, page 106), suggested the possibility of a 70-section field. This estimate included Sun Oil Co.'s shut-in Ellenburger discovery in the southwestern corner of Crockett County as part of the structure. While those doing the seismic shooting aren't talking about what they've found, they now believe the Sun discovery to be on a separate structure, on the same trend.

Excluding the Sun discovery in Crockett County, Brown-Bassett field is now 5 miles long, on a northwest-southeast trend. With the exception of Continental Oil Co. 1 Brown-Bassett, a two-location southwest offset to the most northwesterly well, all drilling has been in a straight line.

How does it compare with Puckett multipay field to the northwest in Pecos County? Puckett field stretches about 7 miles northwest-southeast and is 4 to 5 miles wide. Some 26 sections are considered proved, with considerable acreage in the semiproved status. Puckett field is fairly well defined on the south and west but not on the north and east. Brown-Bassett, like Puckett, has about 1,700 ft. of Ellenburger section.

The Brown-Bassett field discovery drilled 1,200 ft. of gas column, after penetrating 350 ft. of the Ellenburger. The entire section included the Cambro-Ordovician. On the northwest end of the present field, Richardson & Bass 1 Goode found approximately the same Ellenburger section. No. 1 Goode was flat on the Fusselman with Magnolia's discovery, but due to two faults, found the Ellenburger 345 ft. high. This high structural position, plus rumors of optimistic seismic work to the northwest by Shell Oil Co., has added materially to the field's predicted size.

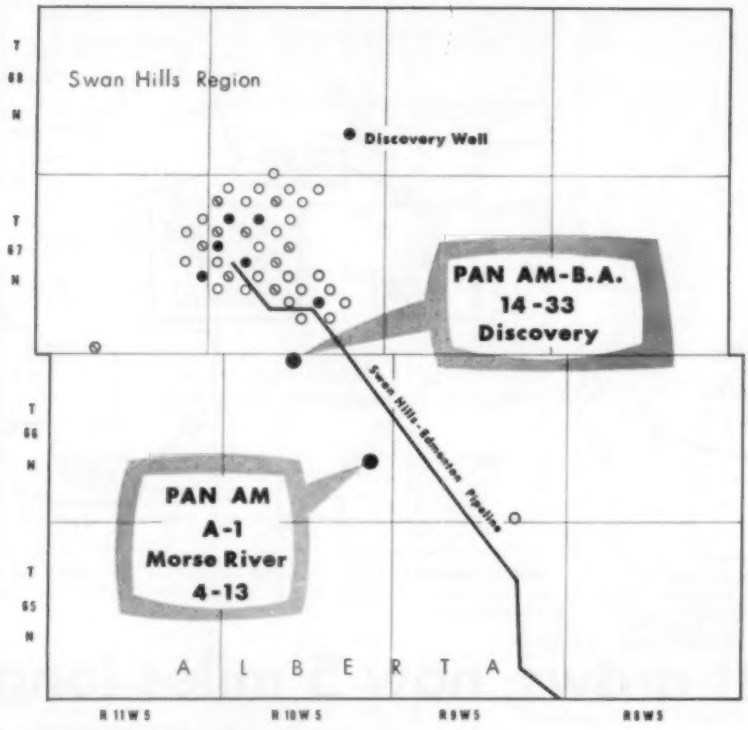
Two wells are still drilling on the northwest end. Continental Oil Co. 1 Brown-Bassett in Section 227 was below 14,402 ft. last week. The Ellenburger here was found 144 ft. low to the field discovery. Tests in the Fusselman have flowed 9,500 M.c.f.d. of gas.

Magnolia and Western Natural 1 Bassett-Goode, Section 228, was below 10,500 ft. at last report.

## Wyoming field adds third field

SOUTHWESTERN WYOMING'S Trail Unit field added its third well and a new-pay gas discovery. Mountain Fuel Supply Co. 3 Trail Unit, NW NW SW 3-13n-100w, Sweetwater County, was completed in a new section of Mesaverde sand from perforations at 5,668-5,740 ft. Flow was 34,500 M.c.f. per day.

The second well in the field, 2 Trail Unit, made 40 M.M.c.f.d. from 6,870-7,068 ft. The discovery well, completed in 1952, made only 4,260 M.c.f.d. from 7,530-68 ft.




## New wells for Swan Hills

**HERE** is Western Canada's most important new oil reservoir-development area—Swan Hills. Home Oil Co. and its partners expect to push down two dozen field wells in this prolific Middle Devonian field this winter. Two important discoveries in the past 2 weeks southeast of the field proper add more furor to this busy region. The new strikes are Pan American-British American 14-33 which flowed 56 bbl. per hour, and Pan American A-1 Morse River which flowed 242 bbl. per day.

# Look for wildcat news in '59 from remote northwestern B.C. area

NORTHWESTERN British Columbia may become Canada's newest oil-hunting grounds. Pan American Petroleum Corp. applied for 12,500,000 acres of permit rights in one of the most obscure and remote areas in Canada. The play seems to stem from the interest shown in Alaska exploration in recent months.

The acreage is located northeast of Prince Rupert in the Stikine River basin. This acreage brings to nearly 16 million acres the total number held, under application, by Pan American in British Columbia.

**Geography . . .** The lands covered by the new application are bordered by 7,000-10,000-ft. mountains. They are about 350 miles west of gas production in northeastern British Columbia. The lands start some 75 miles east of the Queen Charlotte Islands and run about 150 miles further east; then stretch from a point just north of Prince Rupert for almost 200 miles. This land is not a solid block, however. It lies between 127° and 130° 45' West Longitude and 54° 45' and 58° North Latitude.

**Unknown area . . .** Little is known of the area. It is thought that Pan American picked the play off of photogeological studies by the Dominion Government and are basing the intended play on folded structures which contain a Cambrian through Cretaceous section.

Pan Am has not revealed what activity is planned. Surface work will be needed. This could possibly begin next spring.

# Poison Springs—Utah's new frontier

THE YEAR'S most significant dry hole is Tennessee Gas Transmission Co.'s 1 USA-Poison Springs-A in Garfield County, Utah. This northwestern Paradox basin wildcat was temporarily stopped at total depth 6,491 ft. The last swab gage was 1½ bbl. of oil and 59 bbl. salt water in 6 hours. Recovery was from Hermosa-Pennsylvanian at 4,149-74 ft.

This wildcat is of the utmost importance to future drilling in this part of the basin. It found biohermal reefing, excellent oil shows, and discovered the Hermosa here to be sand instead of lime as at Aneth far to the southeast. Poison Springs set off a flurry of wildcatting all around the area, and we can expect a big play here next year. The finding of a reef in this basin is as important as the discovery of Pescadito salt dome in 1957 in far Southwest Texas. That salt-dome discovery led to later production on the dome. Further drilling in northwestern Paradox may see some real news makers in 1959.

# Here's a report on NE Ohio

A SUMMARY of drilling activity in northern Ohio reveals that Russell McConnell et al. have completed six gas wells in the northwest corner of Monroe Township, Ashtabula County. The first three were small; the last three rather good. The last well completed had the largest open flow; 1,360 M.c.f., natural, and 7,770 M.c.f. after fracturing. The gas is being sold to East Ohio Gas Co.

Erie Natural Gas Co. has completed a 35-bbl. oil well in the south part of Monroe Township; is drilling a second one 2¼ miles north.

Belden and Blake completed a well in Kingsville Township, Ashtabula County. It was drilled-in wet and had an unknown amount of gas, natural, but made 3,688 M.c.f after fracturing. The company drilled a dry hole in Denmark Township; and is drilling a second well on the same lease.

The area was leased after Benedum-Trees completed a well in Monroe Township last year. The company drilled two offsets. There was a dry hole 1¼ miles to the east. No other drilling is under way here. Leasing activity continues high in Ashtabula County, one of the least-tested of Ohio areas.

# New Kentucky oil

IN LEE COUNTY near Lyman Creek School and about 1½ miles west of the Breathitt County line, Ned Ware, et al., have completed 1 J. F. Kilburn for 20 bbl. of oil daily from Corniferous lime topped at 1,377 ft. and bottomed at 1,416 ft.

Elevation was recorded as 798 ft.

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# Important wildcats drilled in Indiana in 1957–

1. Spencer County: George P. Ellison 1 Beren, 31-6s-5w. IP 40 BOPD, Aux Vases 1,282 ft. TD 1,286 ft. Opens West Grandview field.

2. Pike County: J. W. Starr 1 A. Egan, 21-3s-6w. IP 90 BOPD, 9 BWPD, Aux Vases 1,172 ft. TD 1,220 ft. Opens West Holland field.

3. Posey County: Rush Creek Oil Co., Inc., 1 W. Wittekindt, 26-5s-13w. IP 90 BOPD, Penn. 1,278 ft. TD 2,038 ft. Opens North Oliver field.

4. Gibson County: T&H Corp. 1 D. Scott et al., 32-2s-12w. IP 6 BOPD, 20 BWPD, Cypress 2,227 ft. TD 2,615 ft. Opens Scott field.

5. Posey County: Rush Creek Oil Co., Inc., 1 J. Burris, 25-7s-14w. IP 10 BOPD, Aux Vases 2,871 ft. TD 3,035 ft. Opens North Spencer field.

6. Pike County: Coy Oil, Inc., 1 E. Richardson, 19-1s-6w. IP 60 BOPD, 40 BWPD, Aux Vases 1,123 ft. TD 1,227 ft. Opens Whiteoak field.

7. Vanderburgh County: Stouder Drilling Co. 1 J. Herschelman,, 7-6s-11w. IP 192 BOPD, Waltersburg 1,825 ft.; Tar Springs 1,967 ft. TD 2,722 ft. Opens Belknap extension.

8. Posey County: C. E. O'Neal & Co. 1 K. Kiltz, 17-6s-13w. IP 48 BOPD, Pennsylvanian 1,307 ft. TD 2,973 ft. Oil field extension and new pay in West Bufkin field.

9. Gibson County: Charles Bury 1 T. and R. Reynolds, 17-3s-10w. IP 48 BOPD, 190 BWPD, Jackson 1,760 ft. TD 1,782 ft. Extension to Fort Branch field.

10. Spencer County: H. C. Farmer 1 J. and E. Doyle, 29-6s-5w. IP 20 BOPD, Cypress 890 ft. TD 908 ft. Extension to Grandview field.

11. Spencer County: Beckham A. Robertson 1 H. and I. Varner, 14-6s-5w. IP 5 BOPD, Ste. Gen. 1,049 ft. TD 1,056 ft. Extension to North Grandview field.

12. Gibson County: C. E. O'Neal & Co. 1 E. Thompson, 33-2s-11w. IP 42 BOPD, Bethel 2,223 ft. TD 2,435 ft. Extension to Owensville East Consolidated field.

13. Gibson County: C. E. O'Neal & Co. 1 K. Smith, 8-2s-11w. IP 22 BOPD, Pennsylvanian 858 ft. TD 2,396 ft. Extension to West Princeton field.

14. Gibson County: D. P. Sturgeon 1 A. Riggs, 17-2s-11w. IP 5 BOPD, 8 BWPD, Pennsylvanian 850 ft. TD 892 ft. Extension to West Princeton field.

15. Posey County: R. K. Petroleum Corp. 1 M. Blount et al., 4-7s-14w. IP 125 BOPD, Tar Springs 2,137 ft. TD 2,142 ft. Extension to Welborn Consolidated field.

16. Knox County: J. T. Speake Drilling Co., Inc., 1-A C. McLin, Mount Carmel area. IP 100 BOPD, Tar Springs 1,666 ft. TD 2,338 ft. New oil pay in North Mount Carmel.

17. Posey County: Howard Atha 1 B. Eilert, 18-8s-13w. IP 20 BOPD, 50 BWPD, Pennsylvanian 1,309 ft. TD 1,859 ft. New oil pay in Powell's Lake field.

18. Posey County: Rush Creek Oil Co., Inc., 1 E. Elliott, 36-7s-14w. IP 19 BOPD, Ste. Gen. 2,959 ft. TD 2,969 ft. New oil pay in North Spencer field.

19. Posey County: Charles C. White 1-A H. Clements, 33-5s-14w. IP 77 BOPD, Aux Vases 2,921 ft. TD 3,103 ft. New oil pay in North Welborn field.

20. Lagrange County: Ambassador Oil Corp. 1 F. Hartman, 2-37n-9e. Dry. TD 3,483 ft. Eau Claire.

21. Steuben County: Ambassador 1 J. Walker, 4-36n-13e. Dry. TD 3,700 ft. Eau Claire.

22. Steuben County: Ambassador 1 H. Shipe, 25-36n-13e. Dry. TD 2,931 ft. Knox.

"The white men call him 'Chief Cloud-on-Title,' whatever that means."

THE OIL AND GAS JOURNAL

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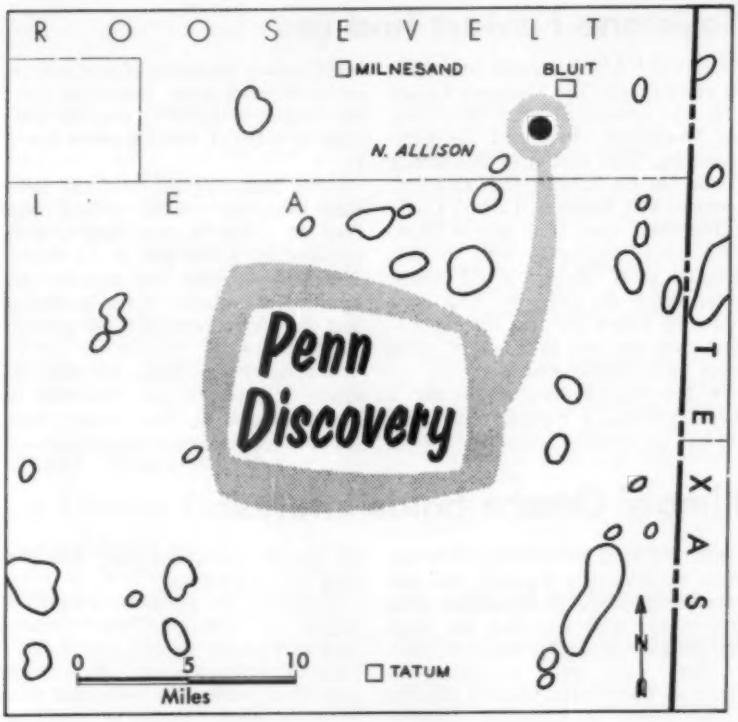



# Roosevelt adds new oil pool

SOUTHERN Roosevelt County in eastern New Mexico has been assured of a Pennsylvanian discovery at Ohio Oil Co. 1 Federal McGrail. Location is in SE NW 20-8s-37e, 3 miles northeast of similar production at North Allison field.

A 4½-hour drill-stem test at 9,450-9,510 ft. had gas in 15 minutes and flowing oil in 90 minutes. In 3 hours it tanked 107.49 bbl. of oil. Flowing pressure ranged from 1,000-1,440 psi. Thirty-minute shut-in pressure was 3,060 psi. Drilling continued below 10,866 ft., on 11,500-ft. contract.

In the Bagley-Hightower area, Lea County, Santiago Oil & Gas Co. 1-30 State reported oil and gas shows on a number of drill-stem tests in the Pennsylvanian.

Oil recovery was made on tests at 9,915-79 and 10,185-10,242 ft. At 10,232-62 ft. the recovery was 2,424 ft. of oil, plus 1,314 ft. of slightly mud-cut oil. A later test at 10,260-87 ft., open 2 hours, recovered 810 ft. of gas in drill pipe, plus 130 ft. of heavily oil and gas-cut mud. Drilling continued below 10,287 ft.

Location is in Section 30-12s-34e, 2½ miles southeast of Hightower field and 12 miles west of Tatum.

# Californians take a dare

THE CURRENT DIFFICULTIES in finding markets for California crude isn't scaring away the more adventurous wildcatters.

A number of interesting tests are under way in some of the state's more remote areas. These include:

**... LaHonda.** Doc Oil Co. of Nevada was running 5½-in. casing to the bottom of a 5,280-ft. wildcat in the rugged LaHonda area of San Mateo County. This play is little more than 2 miles northwest of the small Neaves Petroleum Development Co.'s activity in this central-coastal California county. This general area has attracted wildcatters for years because of the possibility of finding oil at relatively shallow depths. The last significant discovery was several years ago when Union Oil Co. of California found the small Oil Creek field some 12 miles to the southeast.

**... Mexico.** A test being drilled by Border Oil & Gas Corp. 10 miles southeast of Holtville in Imperial County currently holds the distinction of being the rankest wildcat in the state. The drill site itself is only 4 miles north of the Mexican border. The nearest production is 165 miles, as the crow flies, northwest at West Newport in Orange County. Current total depth is 5,650 ft. with a heavier rig in the process of moving on to the hole for still deeper drilling. According to scout reports, the well has had several small oil shows on the ditch.

**... Dead Mountain.** Virtually in a dead heat for the rankest-wildcat title with the Border Oil test is one being drilled by Flamingo Oil Co. on the California-Nevada border. This well has had a fits-and-starts existence since its spud date last January. The operators still label it a 6,000-ft. test. Current total depth is only 2,680 ft. It was reportedly making water and some gas on tests of shallow intervals. The drill site is in NW NE 18-10n-21e, about 17 miles northwest of the border town of Needles and about 10 miles from both the Arizona and Nevada borders.

**... San Juan Capistrano.** Roy Gill, operator, was drilling below 5,758 ft. on a wildcat in SW NE 13-8s-8w near San Juan Capistrano in Orange County. This well currently ranks as the most southerly test in the state associated with production within a reasonable distance. It is located about 20 miles south of the West Newport field, and just 4 miles north of the San Diego County line.

**... Santa Rosa.** W. C. Thompson Gas & Oil Exploration Co. was drilling a wildcat in NE NE 18-6n-7w about 8 miles north of Petaluma gas field of Sonoma County in northern California. This is in a little-drilled area of the state north of San Francisco.

**... Kirkwood.** The most northerly wildcat in the state was one being drilled by Humble Oil & Refining Co. near Kirkwood in Tehama County. Drill site is in NW NW 9-23n-3w. Nearest production is 4 miles northeast in the small North Dome gas field. Humble was drilling below 4,067 ft.

**California highlights . . .** Brazos Oil & Gas Co. is being credited with a new gas-pool discovery in the Lopes sand at 5,456-72 ft. with an extension test in the River Island gas field of Sacramento County. Initial production was 2,800 M.c.f. through a ¼-in. choke. . . . Shell Oil Co. will drill a 12,000-ft. wildcat 3 miles northwest of Rincon production in Santa Barbara County. . . . Standard Oil Co. of California abandoned a 12,250-ft. test in the West Montalvo region of Ventura County.

## New oil at Whitecourt

Beaverhill Lake-Middle Devonian oil flowed at the daily rate of 72 bbl. at Mobil Oil of Canada, Ltd.'s North Whitecourt discovery in Alberta.

This well made the news several months ago when production was found in this zone—the pay at Swan Hills. The Whitecourt area discovery pushes Beaverhill Lake production to its southernmost point in the rapidly expanding play that embraces a huge area of North Central Alberta.

## Alberta well hits

GOOD GAS RECOVERY from a wildcat well in the Boundary Lake area of western Alberta has been reported by Pan American Petroleum Corp.

Pan American-Imperial Oil, Ltd., 1 Floral A, located in LSD 14, 31-84-12w6, flowed an estimated potential of 20 M.M.c.f.d. of gas. Recovery was from the Stoddart formation of Mississippian age, topped at 6,090 ft. through perforations at 6,105-10 ft. The well, which has been completed and is now shut in, was drilled to a total depth of 9,487 ft.

The well site is on a 100,000-acre Crown Reservation Block which adjoins British Columbia and is about 50 miles east of Fort St. John, B. C. Both gas and oil production have been proved in the Triassic some 10 to 15 miles west of the 1 Floral A. Pan American and Imperial share interest in the well and acreage.

## Keystone hunters find gas

PENNSYLVANIA reports two wildcat completions. The Margaret Rupert well was completed after fracturing the Onondaga chert and Oriskany sandstone. This well is in Armstrong County on the Roaring Run anticline, operated by Columbian Carbon Co.

The final open flow was 4 M.M. c.f.d. after fracturing with a rock pressure of 3,750 psi. in 72 hours. Total depth is 7,166 ft. This well opens up a new gas area for exploration. Nearest well is about 8 miles away on a parallel structure.

• The second discovery is the 1 Royal Rhodes, a Felmont Oil Corp. wildcat in Jenners Township, Somerset County. Location of the well is on the Boswell dome. Onondaga chert was topped at 8,259 ft. and the Oriskany at 8,417 ft. Total depth is 8,450 ft.

After fracturing the chert and Oriskany sand, the well had a final open flow of 1,976 M.c.f.d. and a rock pressure of 3,590 psi. in 72 hours. The Boswell dome lies between the Laurel Hill anticline to the northwest and the Negro Mountain anticline to the southeast.

• Other Pennsylvania gas news includes a reported gas discovery in the Medina at an Erie County wildcat in northwestern Pennsylvania.

## Illinois' Omaha holds interest

ONE NEW GAS POOL, Gillespie West in Macoupin County, was discovered in Illinois in November. One shut-in gas well has thus far been completed in the pool.

There were seven extensions to pools, as follows: one each to Kincaid Consolidated in Christian County, Ashmore South in Coles County, Sailor Springs Consolidated in Effingham County, Kell in Jefferson County, Carlinville in Macoupin County, Brown in Marion County, and Johnsonville Consolidated in Wayne County. The extensions to Ashmore South, Carlinville and Brown pools are gas wells.

Wayne County, with 28 completions, had the most completions for the month. Gallatin County followed with 22 completions.

Two areas of particular interest in Illinois in November were Omaha pool in Gallatin County and Raleigh pool in Saline County. In Omaha pool three wells were completed with initial production gages of 1,000 or more barrels of oil per day, flowing from the Aux Vases formation. A number of wells in the same pool were completed for several hundred barrels of oil per day. In Raleigh pool one well was completed with an initial production of 1,488 bbl. of oil per day and another for 475 bbl. per day, both from the Aux Vases formation.

Estimated production for Illinois for November is 6,697,000 bbl. of oil.

## Summary of Arbuckle production

| Pool: | Woodrow | Royal | Loco | SE Frederick | West Frederick |
|---|---|---|---|---|---|
| County: | Jefferson | Garvin | Stephens | Tillman | Tillman |
| Average producing depth, ft.: | 2,000 | 3,500 | 2,100 | 4,700 | 5,000 |
| Gravity of oil: | 35° | 28°-39° | 35° | 33° | 33° |
| Arbuckle producing formation: | Cool Creek | Lower West Spring Creek | Kindblade | Upper West Spring Creek | Upper West Spring Creek |
| Lithology: | Dolomite | Limestone and dolmite | Brecciated dolomite | Dolomite | Dolomite |
| **Character of Producing Zone:** | | | | | |
| Porosity, ft.: | 9 | 35 | 2 | 10 | Top 15 |
| Feet below Arbuckle: | 3 | 140 | 30 | 140 | ..... |
| | 10 wells | 9 wells | 2 wells | 2 wells | 11 wells |
| Initial prod: bbl. per day: | 80 (partly from Hoxbar limestone) | 112 to 1,300 (flow or pump) | 350 (flow) | 150 (flow—active 1958) | 1.39 million barrel to 1-1-58 |
| Arbuckle discovery Date: | April 1950 | May 1953 | July 1955 | October 1957 | March 1940 |
| Structural control: | Class I—Topographic highs under unconformities. | | | Class IIa—Unfaulted anticlines | |
| Stratigraphic relations: | Eroded Arbuckle under Virgil or Hoxbar (Pennsylvanian) | | | Upper Arbuckle production under Simpson | |

*Porosity in zone 85 to 220 ft. thick. †Porosity in zone 80 to 90 ft. thick. ‡Totaling 400 ft. or more thick. §Open-flow potential, 1, 1958, 1.08 million barrels . Active 1958.

## McClosky oil found at Hoosier wildcat

INDIANA'S Vanderburgh County has a new oil discovery 5 miles southeast of Cynthiana in NW NE NW 32-4s-11w. It is the Mayhew Oil Co., Inc., and Kendall-Davis Drilling Co., Inc. 1 Steckler-Rexing Unit.

The well swabbed at the hourly rate of 15 bbl., natural, from McClosky at 2,561-66 ft. A drill-stem test at 2,556-68 ft. gassed in 6 minutes, flowing clean oil in 1 hour and 55 minutes. This well is more than 2 miles from other similar production.

## First dual well at Llanos field

NORTHWESTERN Kansas' Llanos field in Sherman County added its first dual completion last week. Phillips Petroleum Co. completed from both the Marmaton and Lansing-Kansas City at its 1 Hartley-A in C SW SE 3-6s-37w, north field extension.

The Pennsylvanian well made 345 bbl. per day from the Marmaton; 289 bbl. per day from the Lansing-Kansas City. Both zones were pumped. Other wells in this new field and province opener have had oil in Cherokee, Marmaton, and the Lansing-Kansas City. Dual completion is also slated for 3 Llanos in C NE NW 10-6s-37w, a west extension. The Marmaton yielded 265 bbl. per day at the 3 Llanos well.

## *Books for oil finders*

### Texas

THE SECOND EDITION of "Research Study of Shut-In Gas Wells in Texas" has been published by Austin Oil & Gas Publishing Co., Box 5146, West Austin Station, Austin.

The compilation of wells is arranged alphabetically by Railroad Commission Districts. The district is by counties, which in turn are alphabetically broken down into field, operator, lease and well number.

Survey, date of completion, perforation, formation or reservoir, pressures, gas gravity and potential test reported in M.c.f. are tabulated for each field. Data includes wells reported through June 1, 1958.

The second edition covers districts 5, 6, 7-B, 7-C, 8, 9, and 10. These districts are in East Texas, West Central, West Texas, and Texas Panhandle.

The first edition was the same data, covering Texas Railroad Commission Districts 1, 2, 3, and 4.

### New Mexico

"LEXICON of New Mexico Geologic Names: Precambrian Through Paleozoic," is a new publication of the State Bureau of Mines and Mineral Resources, Campus Station, Socorro, N. M. This 1958 publication is designated Bulletin 61.

Acceleration of geologic work in New Mexico has emphasized the need for an up-to-date lexicon of published geologic names used in the state. The book gives formation and member names, with origins and pertinent reference work.

## Texas Panhandle Morrow pool opens

DUAL Morrow oil and gas production was opened in northeastern Roberts County in the Texas Panhandle. The discovery well is El Paso Natural Gas Co. 1 Mitchell, 11 miles northwest of Canadian.

The Pennsylvanian discovery flowed at the rate of 676 bbl. of oil per day on various chokes from upper Morrow perforations at 9,914-40 ft.; from 10,004-14 ft. it flowed 2,830 M.c.f.d. of gas plus 41 bbl. distillate per 1 M.M.c.f. of gas.

## Alberta's Simonette well flows reef oil

Initial production of 528 bbl. of oil daily is reported at Shell Oil Co.'s Simonette River Devonian D3 reef discovery in Central West Alberta.

The important strike is Shell-Petrol-Explorers 12-9-63-25 Simon, LSD 12, 9-63-25w5. It is considered to be the oil highlight of 1958 in Alberta.

## *Successful Wildcats*

**WESTERN CANADA**

Alberta: Cal-Standard 6-25 Sunnynook, LSD 6, 25-26-12w4. Viking gas discovery. TD 4,105 ft.

British Columbia: Pacific-Imperial 99-J Jedney, N.T.S. Map 94-G-1. Triassic gas discovery. TD 5,335 ft.

**CALIFORNIA**

Kern County: Norris Oil Co. 41-16 Norris-Frick, NE NW 16-31s-29e, 100 BOPD, 53° gravity, 0.1% cut, 16/64-in. choke, 700 M.c.f.d., perfs. 9,856-88 ft. and 9,940-10,010 ft., TD 10,490 ft. (New pool discovery in Mountain View field.)

Ventura County: Richfield Oil Corp. 54-27 State 1466, 62 BOPD, 13-3n-25w, 30.3° gravity, 1% cut, 15 M.c.f.d., perfs. 2,421-2,521 ft., TD 2,648 ft. (New field discovery on 1,170-acre offshore lease at Rincon.)

Sacramento County: Henry Hottinger, 2 Joe Lopes, NW SW 17-4n-4e, 635 M.c.f.d., 12/64-in. choke, perfs. 3,448-52 ft. and 3,456-70 ft., TD 3,737 ft., (Shallower pool discovery in River Island Gas Field.)

**LOUISIANA OFFSHORE**

Eugene Island area: Sinclair Oil & Gas Co. 1 OCS-2439, Block 190, Eugene Island area, Gulf of Mexico. IP 6 BOPD and 4,560 M.c.f.d., ¼-in., 45.6°, TP 2,800 psi., perf. 7,460-68 ft. TD 10,172 ft. New pay in Eugene Island Block 188 field.

**SOUTH LOUISIANA**

Beauregard Parish: Sunray Mid-Continent Oil Co.2-C Lutcher-Moore, 29-7s-11w.

## in southern Oklahoma

| Butterly<br>Garvin | SW Lone Grove<br>Carter | SE Hoover<br>Murray-Garvin |
|---|---|---|
| 4,300 | 4,800 | 5,200-7,500 |
| 35° | 32° | 38° |
| Upper West Spring Creek Limestone and dolomite | Upper West Spring Creek Sandstone and sandy dolomite | Lower West Spring Creek & upper Kindblade Limestone and dolomite |
| *85 to 220 | †80 to 90 | ‡400 |
| 3 to 30 | 20 | 1,000 |
| 4 wells | 13 wells | §23 wells |
| 18 to 114 (flow or pump) | 11 to 400 (flow or pump) | 2,400 |
| May 1957 | January 1950 | November 1955 |
| Class IIb—Closed anticlines cut by normal faults | | Class IIc—Steeply folded Anticline cut by thrust fault |

Production deep within arbuckle under Simpson dual completion in Arbuckle. Cumulative production to October

THIS TABLE is supp!emental to the article, "Southern Oklahoma: Golden Province for Oil Finders," by William E. Ham. This feature appeared in last week's Journal. The tabulation should have appeared with the article as Table 1, but was inadvertently omitted.

# November's Completion Score

| | TOTAL COMPLETIONS | | | | | | | WILDCAT WELLS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Crude | Cond. | Gas | Dry | Service | Footage | Total | Crude | Cond. | Gas | Dry | Footage | C.T. | Act. op. |
| Alabama | 6 | 4 | 0 | 0 | 2 | 0 | 56,590 | 2 | 0 | 0 | 0 | 2 | 10,322 | 0 | 25 |
| Alaska | 1 | 0 | 0 | 0 | 1 | 0 | 11,653 | 1 | 0 | 0 | 0 | 1 | 11,653 | 0 | 2 |
| Arizona | 1 | 0 | 0 | 0 | 1 | 0 | 802 | 1 | 0 | 0 | 0 | 1 | 802 | 1 | 3 |
| Arkansas | 65 | 32 | 0 | 4 | 28 | 1 | 212,422 | 10 | 0 | 0 | 0 | 10 | 37,600 | 0 | 115 |
| California | 101 | 49 | 0 | 5 | 33 | 14 | 495,933 | 26 | 3 | 0 | 0 | 23 | 141,577 | 1 | 135 |
| Colorado | 67 | 4 | 1 | 11 | 51 | 0 | 329,587 | 42 | 0 | 1 | 4 | 37 | 195,102 | 0 | 125 |
| Illinois | 293 | 115 | 0 | 8 | 118 | 52 | 654,138 | 43 | 2 | 0 | 2 | 39 | 81,932 | 11 | 491 |
| Indiana | 90 | 37 | 0 | 1 | 52 | 0 | 147,114 | 32 | 7 | 0 | 0 | 25 | 49,281 | 30 | 125 |
| Kansas | 459 | 204 | 0 | 22 | 222 | 11 | 1,599,880 | 99 | 14 | 0 | 1 | 84 | 360,864 | 11 | 430 |
| Kentucky | 262 | 198 | 0 | 6 | 55 | 3 | 271,424 | 16 | 4 | 0 | 0 | 12 | 30,482 | 250 | 375 |
| Louisiana | 302 | 129 | 25 | 26 | 117 | 5 | 2,117,671 | 38 | 1 | 1 | 1 | 35 | 280,669 | 0 | 472 |
| North | 139 | 49 | 0 | 22 | 68 | 0 | 481,276 | 23 | 1 | 0 | 1 | 21 | 103,122 | 0 | 180 |
| South | 139 | 64 | 19 | 3 | 48 | 5 | 1,394,363 | 15 | 0 | 1 | 0 | 14 | 177,547 | 0 | 251 |
| Offshore | 24 | 16 | 6 | 1 | 1 | 0 | 242,032 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 |
| Michigan | 33 | 16 | 0 | 1 | 16 | 0 | 89,209 | 10 | 3 | 0 | 1 | 6 | 30,122 | 17 | 90 |
| Mississippi | 37 | 16 | 2 | 0 | 19 | 0 | 308,084 | 11 | 1 | 0 | 0 | 10 | 88,460 | 0 | 73 |
| Montana | 23 | 8 | 0 | 0 | 15 | 0 | 112,034 | 9 | 0 | 0 | 0 | 9 | 51,004 | 1 | 49 |
| Nebraska | 74 | 26 | 0 | 0 | 48 | 0 | 445,823 | 38 | 8 | 0 | 0 | 30 | 220,066 | 0 | 60 |
| New Mexico | 181 | 91 | 1 | 55 | 34 | 0 | 789,661 | 24 | 2 | 0 | 1 | 21 | 114,868 | 38 | 169 |
| West | 85 | 26 | 1 | 50 | 8 | 0 | 317,841 | 4 | 0 | 0 | 0 | 4 | 10,230 | 4 | 86 |
| East | 96 | 65 | 0 | 5 | 26 | 0 | 471,820 | 20 | 2 | 0 | 1 | 17 | 104,638 | 34 | 83 |
| New York | 45 | 21 | 0 | 1 | 3 | 20 | 67,926 | 3 | 0 | 0 | 0 | 3 | 11,114 | 45 | 11 |
| North Dakota | 26 | 15 | 0 | 0 | 11 | 0 | 164,886 | 6 | 0 | 0 | 0 | 6 | 29,523 | 0 | 48 |
| Ohio | 90 | 37 | 0 | 25 | 26 | 2 | 238,625 | 7 | 2 | 0 | 2 | 3 | 27,107 | 90 | 181 |
| Oklahoma | 481 | 250 | 6 | 25 | 182 | 18 | 1,635,514 | 72 | 12 | 0 | 3 | 57 | 361,545 | 106 | 801 |
| Pennsylvania | 45 | 10 | 0 | 26 | 3 | 6 | 169,363 | 2 | 0 | 0 | 2 | 0 | 15,616 | 45 | 22 |
| South Dakota | 3 | 0 | 0 | 0 | 3 | 0 | 4,104 | 3 | 0 | 0 | 0 | 3 | 4,104 | 2 | 2 |
| Tennessee | 2 | 0 | 0 | 0 | 2 | 0 | 1,840 | 2 | 0 | 0 | 0 | 2 | 1,840 | 2 | 1 |
| Texas | 1,725 | 991 | 53 | 62 | 587 | 32 | 6,848,937 | 296 | 14 | 5 | 3 | 274 | 1,290,783 | 99 | 1,276 |
| District 1 | 58 | 26 | 1 | 3 | 27 | 1 | 156,126 | 18 | 1 | 0 | 1 | 16 | 47,760 | 5 | 62 |
| District 2 | 53 | 13 | 9 | 4 | 27 | 0 | 332,807 | 16 | 1 | 1 | 0 | 14 | 114,860 | 0 | 37 |
| District 3 | 92 | 32 | 3 | 5 | 52 | 0 | 589,024 | 22 | 0 | 0 | 0 | 22 | 173,415 | 0 | 115 |
| District 4 | 71 | 12 | 11 | 3 | 42 | 3 | 346,144 | 21 | 1 | 3 | 0 | 17 | 120,385 | 0 | 88 |
| East | 117 | 61 | 11 | 0 | 45 | 0 | 586,450 | 24 | 0 | 0 | 0 | 24 | 136,356 | 0 | 62 |
| District 7-B | 288 | 121 | 2 | 8 | 156 | 1 | 727,109 | 78 | 2 | 0 | 1 | 75 | 187,983 | 0 | 106 |
| West | 544 | 439 | 6 | 5 | 84 | 10 | 2,580,739 | 52 | 5 | 0 | 1 | 46 | 248,882 | 39 | 567 |
| District 9 | 383 | 219 | 3 | 9 | 136 | 16 | 1,054,609 | 55 | 4 | 0 | 0 | 51 | 191,556 | 55 | 134 |
| District 10 | 119 | 68 | 7 | 25 | 18 | 1 | 475,929 | 10 | 0 | 1 | 0 | 9 | 69,586 | 0 | 105 |
| Utah | 29 | 19 | 0 | 3 | 7 | 0 | 150,833 | 2 | 0 | 0 | 0 | 2 | 10,468 | 0 | 56 |
| Washington | 1 | 0 | 0 | 0 | 1 | 0 | 7,353 | 1 | 0 | 0 | 0 | 1 | 7,353 | 0 | 1 |
| West Virgina | 75 | 7 | 0 | 53 | 14 | 1 | 202,562 | 3 | 0 | 0 | 2 | 1 | 17,486 | 75 | 165 |
| Wyoming | 57 | 16 | 0 | 9 | 32 | 0 | 244,781 | 30 | 1 | 0 | 2 | 27 | 127,098 | 0 | 125 |
| Nov. 1958 | 4,574 | 2,295 | 88 | 343 | 1,683 | 165 | 17,378,749 | 829 | 74 | 7 | 24 | 724 | 3,608,841 | 824 | 5,428 |
| Oct. 1958 | 4,518 | 2,321 | 67 | 326 | 1,683 | 121 | 16,464,416 | 871 | 75 | 10 | 16 | 770 | 3,957,469 | 1,215 | 5,234 |
| Cum. 1958 | 44,568 | 21,909 | 1,015 | 3,384 | 17,060 | 1,200 | 180,458,088 | 8,791 | 845 | 141 | 244 | 7,561 | 40,721,019 | 8,032 | .... |
| Cum. 1957 | 49,451 | 25,430 | 582 | 3,547 | 18,898 | 994 | 203,865,547 | 10,789 | 1,095 | 95 | 343 | 9,256 | 51,389,092 | .... | .... |

D.D. = 28: Wyo. 4, Kans. 1, Ill. 3, Ind. 1, Okla. 15, Ala. 1, Texas (4) 1, Texas (3) 2.

# . . . and Western Canada

| | TOTAL WELLS | | | | | | WILDCATS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Oil | Gas | Dry | Footage | Cum. 1958 | Total | Oil | Gas | Dry | Footage | Cum. 1958 |
| Alberta | 139 | 101 | 15 | 23 | 763,519 | 1,501 | 21 | 2 | 2 | 17 | 130,398 | 373 |
| Saskatchewan | 60 | 37 | 0 | 23 | 258,968 | 709 | 18 | 5 | 0 | 13 | 68,314 | 186 |
| Manitoba | 7 | 5 | 0 | 2 | 15,704 | 84 | 0 | 0 | 0 | 0 | 0 | 11 |
| British Columbia | 8 | 0 | 1 | 7 | 40,807 | 78 | 7 | 0 | 1 | 6 | 36,949 | 60 |
| Northwest Territories | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 7 |
| Western Canada | 214 | 143 | 16 | 55 | 1,078,998 | 2,379 | 46 | 7 | 3 | 36 | 235,661 | 637 |

IP 124-.80 BOPD, 5/32-in., 48.7°, TP 1,000 psi., GOR 416 cu. ft. per bbl., perf. 9,204-14 ft. TD 9,600 ft. New pay and east extension West DeQuincy field.

Rapides Parish: A. J. Hodges Industries, Inc., et al. 1 Nesbitt, 33-6s-32, 4 miles south of Nebo field. IP 11 BOPD, ½-in., 41.6°, TP 15 psi., GOR nil, perf. 4,095-97 ft. TD 5,565 ft. New field.

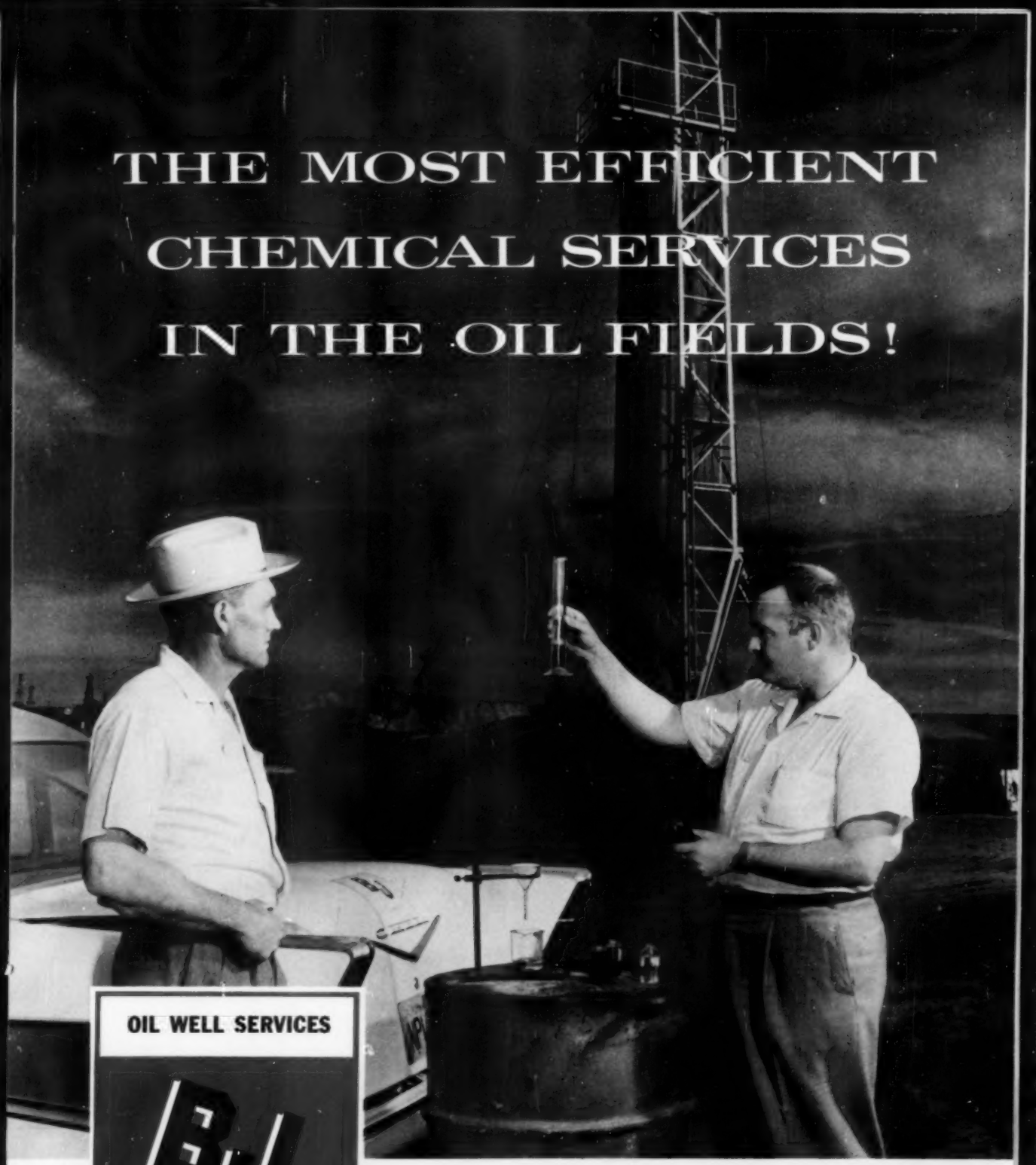
A. J. Hodges Industries, Inc., et al. 1 Lee, 4-5n-3e. IPP 41 BOPD, 41.8°, perf. 4,406-12 ft. TD 5,110 ft. Second well and new pay in unnamed field opened by same operator's 1 Nesbitt (above).

St. Bernard Parish: O'Meara Brothers 5 State Lease 2192, Township 16s-17e, in Lake Fortuna. IP 154 BOPD, ⅛-in., 28.9°, TP 775 psi., perf. 7,166-70 ft. TD 8,600 ft. New oil pay in Lake Fortuna field.

Terrebonne Parish: Petroleum, Inc., and Harry Hurt, Inc., 1 Cole, 22-17s-18e, 1 mile southeast of East Houma field. IP 2,450 M.c.f.d., 5/32-in., TP 4,350 psi., perf. 11,285-88 ft. TD 13,248 ft. New field.

**EAST TEXAS**

Cherokee County: Union Producing Co. 1 Rube Sessions, John Durst Sur., A-15, 2½ miles northeast of Wells. IP 750 M.c.f.d. gas, estimated open-flow, James

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From the inception of oil well acidizing in 1932, BJ Service has led the way in well stimulation procedures. BJ leads in experienced manpower—in field-proven personnel with an intimate knowledge of the right treating techniques for *your* area. BJ leads in treating solutions and methods—developed by continuing laboratory and field-testing programs to answer every down-hole need. BJ leads in equipment—designed and built in our own manufacturing division for one job, one trip service. And BJ leads in availability, with a network of strategically located field stations in every major oil field area. It's this combination that has given BJ Service its reputation for the "most effective chemical services in the oil fields." If you're interested in *results*, call BJ Service for your next well stimulation job.

**Chemical Services Laboratory, where BJ SERVICE maintains its 26-year leadership in advanced new treating solutions and techniques.**

### MUD-SOL

A patented well-treating solution designed to remove drilling mud and filter cake from the well bore and adjacent areas. Especially recommended for use in formations that are relatively insoluble in hydrochloric acid.

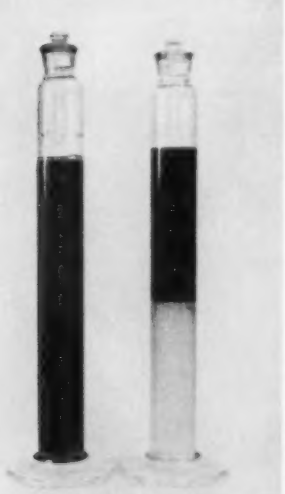
### CLEANUP ACID

Inhibited 5% or 15% hydrochloric acid with special additives. Acts to dissolve carbonates, loosen and disperse filter cake solids and increase permeability of any filter cake materials remaining in the formation. Recommended for use as a "spearhead" before fracturing treatments.

### ATPET 277

A water block removal agent, added to kerosene, crude or diesel oil, that causes the blocking water to become emulsified in oil. This effects the necessary change in surface tension and allows the fluid to flow freely from the well.

**Proof of demulsifying properties of J-Type Acid. J-Type Acid (right) has completely fallen out of oil. Regular acid solution (left) is still emulsified.**



### J-TYPE ACID

Inhibited hydrochloric acid with surfactants to lower surface and interfacial tension and prevent formation of emulsions. Used in treatment of carbonate reservoirs to increase permeability, leave drainage channels free of emulsion and to clean up in the shortest possible time.

### GELLED ACID W

A viscous acid-kerosene emulsion characterized by low fluid loss and high viscosity. Designed to penetrate farther into the formation and to penetrate oil-bearing formations more easily than water-bearing formations. Demulsifiers may be added for J-Type Gelled Acid W.

### J-10

An oil soluble emulsion breaker. Changes the existing surface tension relationship between the fluid and the rock, breaking most emulsions found in producing formations. Can also be employed as a spearhead preceding acidizing or fracturing treatments.

### FORMJEL

A metallic soap kerosene gel used to temporarily block off one zone from a few hours up to 12 days while treating a less permeable zone. Seals leaking packers and stops communication between perforated intervals during stimulation. Can be used with bottom-hole temperatures up to 200°F.

**Dramatic illustration of high viscosity of Formjel in its gelled state. Formjel is one of several blocking agents available from BJ SERVICE.**

**OIL WELL SERVICES**

BJ Service

A BORG-WARNER SUBSIDIARY

### FIRMJEL

Permanent blocking material of very high viscosity, designed to correct gas/oil ratios in wells with open hole or perforated completions. Contains fluids in the formation for long periods of time, yet will not prevent packers from being pulled.

### SELECTOJEL

A viscous oil base gel containing selected graded-to-size granular materials. Used to temporarily block zones opened before or during stimulation, forcing acid or frac fluid to penetrate new zones. Remains in pumpable condition throughout treatment.

BJ SERVICE, INC.

A BORG-WARNER SUBSIDIARY

LONG BEACH, CALIFORNIA • FORT WORTH, TEXAS / *Stations throughout Mid-Continent, Gulf Coast, Permian Basin, Rocky Mountain and California areas*

Oil Well Cementing and Drill Stem Testing Provided in Canada by BJ Service of Canada Ltd

Printed in U.S.A.

# November Footage Tally

| | FIELD WELLS | | | | | WILDCAT WELLS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Oil | Cond. | Gas | Dry | Service | Oil | Cond. | Gas | Dry |
| Alabama | 46,268 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 10,322 |
| Alaska | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 11,653 |
| Arizona | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 802 |
| Arkansas | 92,665 | ..... | 25,897 | 54,460 | 1,800 | ..... | ..... | ..... | 37,600 |
| California | 237,458 | ..... | 24,097 | 43,502 | 49,299 | 27,765 | ..... | ..... | 113,812 |
| Colorado | 21,327 | ..... | 35,936 | 77,222 | ..... | ..... | 5,609 | 24,644 | 164,849 |
| Illinois | 274,095 | ..... | 5,390 | 204,362 | 88,359 | 4,835 | ..... | 958 | 76,139 |
| Indiana | 54,499 | ..... | 850 | 42,484 | ..... | 9,517 | ..... | ..... | 39,764 |
| Kansas | 643,379 | ..... | 96,392 | 464,702 | 34,543 | 51,837 | ..... | 3,097 | 305,930 |
| Kentucky | 156,868 | ..... | 8,210 | 73,161 | 2,703 | 7,053 | ..... | ..... | 23,429 |
| Louisiana | 863,559 | 304,918 | 104,851 | 549,616 | 14,058 | 2,669 | 12,050 | 3,000 | 262,950 |
| North | 118,462 | ..... | 63,618 | 196,074 | ..... | 2,669 | ..... | 3,000 | 97,453 |
| South | 589,712 | 242,621 | 31,374 | 339,051 | 14,058 | ..... | 12,050 | ..... | 165,497 |
| Offshore | 155,385 | 62,297 | 9,859 | 14,491 | ..... | ..... | ..... | ..... | ..... |
| Michigan | 30,371 | ..... | ..... | 28,716 | ..... | 8,603 | ..... | 2,390 | 19,129 |
| Mississippi | 140,787 | 12,154 | ..... | 66,683 | ..... | 14,422 | ..... | ..... | 74,038 |
| Montana | 33,405 | ..... | ..... | 27,625 | ..... | ..... | ..... | ..... | 51,004 |
| Nebraska | 111,552 | ..... | ..... | 114,205 | ..... | 51,000 | ..... | ..... | 169,066 |
| New Mexico | 384,845 | 7,054 | 220,044 | 62,850 | ..... | 17,403 | ..... | 16,100 | 81,365 |
| West | 85,236 | 7,054 | 202,602 | 12,719 | ..... | ..... | ..... | ..... | 10,230 |
| East | 299,609 | ..... | 17,442 | 50,131 | ..... | 17,403 | ..... | 16,100 | 71,135 |
| New York | 27,050 | ..... | 2,712 | ..... | 27,050 | ..... | ..... | ..... | 11,114 |
| North Dakota | 100,451 | ..... | ..... | 34,912 | ..... | ..... | ..... | ..... | 29,523 |
| Ohio | 105,377 | ..... | 53,124 | 48,063 | 4,954 | 8,324 | ..... | 7,476 | 11,307 |
| Oklahoma | 683,834 | 41,302 | 121,311 | 379,808 | 47,714 | 85,944 | ..... | 17,110 | 258,491 |
| Pennsylvania | 17,265 | ..... | 117,010 | 7,412 | 12,060 | ..... | ..... | 15,616 | ..... |
| South Dakota | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 4,104 |
| Tennessee | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1,840 |
| Texas | 3,787,314 | 381,855 | 216,668 | 1,100,037 | 72,280 | 83,614 | 47,967 | 22,649 | 1,136,553 |
| Dist. 1 | 48,563 | 11,000 | 18,050 | 29,911 | 842 | 1,920 | ..... | 3,600 | 42,240 |
| Dist. 2 | 73,062 | 63,750 | 11,229 | 69,906 | ..... | 8,515 | 9,523 | ..... | 96,822 |
| Dist. 3 | 198,960 | 42,987 | 14,149 | 159,513 | ..... | ..... | ..... | ..... | 173,415 |
| Dist. 4 | 49,685 | 60,651 | 9,667 | 98,755 | 7,001 | 8,515 | 28,284 | ..... | 83,586 |
| East | 268,614 | 75,463 | ..... | 106,017 | ..... | ..... | ..... | ..... | 136,356 |
| Dist. 7-B | 317,608 | 8,148 | 22,374 | 190,679 | 317 | 11,240 | ..... | 3,950 | 172,793 |
| West | 2,056,497 | 57,857 | 18,079 | 173,740 | 25,684 | 32,848 | ..... | 15,099 | 200,935 |
| Dist. 9 | 522,730 | 13,065 | 55,185 | 234,937 | 37,136 | 20,576 | ..... | ..... | 170,980 |
| Dist 10 | 251,595 | 48,934 | 67,935 | 36,579 | 1,300 | ..... | 10,160 | ..... | 59,426 |
| Utah | 107,996 | ..... | 12,679 | 19,690 | ..... | ..... | ..... | ..... | 10,468 |
| Washington | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 7,353 |
| West Va. | 15,887 | ..... | 135,433 | 31,091 | 2,665 | ..... | ..... | 9,646 | 7,840 |
| Wyoming | 55,522 | ..... | 41,952 | 20,209 | ..... | 4,400 | ..... | 11,617 | 111,081 |
| **Total U. S.** | **7,991,774** | **747,283** | **1,222,556** | **3,450,810** | **357,485** | **377,386** | **65,626** | **134,303** | **3,031,526** |
| Western Canada | 701,528 | ..... | 62,395 | 79,414 | ..... | 37,362 | ..... | 13,628 | 184,671 |
| Alberta | 545,682 | ..... | 62,395 | 25,044 | ..... | 16,846 | ..... | 7,920 | 105,632 |
| Saskatchewan | 144,578 | ..... | ..... | 46,076 | ..... | 20,516 | ..... | ..... | 47,798 |
| Manitoba | 11,268 | ..... | ..... | 4,436 | ..... | ..... | ..... | ..... | ..... |
| British Columbia | ..... | ..... | ..... | 3,858 | ..... | ..... | ..... | 5,708 | 31,241 |

9,530-61 ft. TD 10,739 ft., elev. 321 ft. Bottom-hole shut-in pressure 4,997 psi. Discovery, Wells field.

### SOUTHWEST TEXAS

Duval County: Hiawatha Oil & Gas Co. 1 Gruy estate, Sec. 251, J. Stephenson Sur., A-1168, 22 miles southwest of Freer. IPP 55.56 BOPD, 21.1°, GOR 212 cu. ft. per bbl., perf. 2,656½-2,660 ft. TD 3,789 ft.

C. C. Winn 1 A. G. Salinas estate, Section 143, J. Poitevent Sur., A-388, 10 miles north of San Diego. IP 2,720 M.c.f.d., dry gas, shut-in pressure 1,480 psi., perf. 4,623-33 ft., Frio, and AOF 11 M.M.c.f.d., dry gas, shut-in pressure 1,461 psi., perf. 3,946-56 ft. TD 4,765 ft. New field—Speck.

Webb County: Copano Oil Co. et al. 1 Desiderio Trevino, Joaquin Grent, 35 miles northwest of Laredo. AOF 2,600 M.c.f.d., dry gas, shut-in TP 2,346 psi., perf. 8,970-9,014 ft., Edward lime. TD 9,110 ft. New field—Galan.

### TEXAS GULF COAST

Jackson County: Sun Oil Co. 5 Hackbarth, Patrick Scott Sur., A-69, 5½ miles north of Lolita. IP 130.98 BOPD, ¼-in., 32.5°, TP 840 psi., GOR 599 cu. ft. per bbl., perf. 5,819-21 ft., Frio. TD 6,005 ft. New pay in North LaWard field.

Liberty County: Trice Production Co. 1 Polk, Lot 2, Block 23, Liberty Town Tract East League, A-359, Liberty Townsite. IP 110 BOPD, 3/32-in., 30.2°, TP 1,400 psi., GOR 550 cu. ft. per bbl., perf. 9,471-75 ft., Cook Mountain. TD 9,552 ft. New pay in Liberty Townsite (South Liberty) field.

Polk County: Oil Reserves Corp. 3 Carter-Quinn, A. Morales Sur., A-52, 3 miles southeast of Segno. IP 142.04 BOPD, 9/64-in., 44°, TP 850 psi., GOR 798 cu. ft. per bbl., perf. 5,318-21 ft., Yegua. TD 6,600 ft. New pay in Segno field.

San Patricio County: Sunray Mid-Continent Oil Co. 1 Bluntzer, Block 87, San Patricio de Hibernia Grant, 1 mile northeast of San Patricio. IP 102.06 BOPD, 9/64-in. x 7/64-in., 40.3°, TP 800 psi., GOR 756 cu. ft. per bbl., perf. 6,114-18 ft., Frio. TD 6,201 ft. New pay in San Patricio field.

### WEST CENTRAL TEXAS

Coleman County: Louis Franklin & Son 1-B McCord, C. L. Roberts Sur. 12, 2½ miles northeast of Glen Cove. IP 180 BOPD, ¼-in. choke, 41°.

Haskell County: Fletcher Oil & Gas Drilling Corp. 1 Shelly, J. Korns Sur., 4 miles east of Rochester. IPP 120 BOPD, 39°, pay 4,749-55 ft. TD 4,801 ft.

Jones County: M. A. Grisham 1 R. Q. Garrett, 10-17-T&P Sur., 2 miles southwest of Truby. IPP 83 BOPD, 39°, GOR 320:1, King sand 2,060-63 ft. TD 2,765 ft.

Taylor County: LaGorce Oil Co. et al 3-B L. N. Brown, R. Ortiz Sur., 2½ miles east of View. IP 88 BOPD, 15/64-in. choke, 40°, GOR 125:1, Dothan sand 1,848-54 ft. TD 1,958 ft.

(Additional field news on pages 119 and 123)

# Gulf Mapping Political Plan

## . . . of action to offset organized labor's influence over government. Support of the movement has been surprising.

INITIAL STEPS are being taken to launch Gulf Oil Corp.'s "Operation Politics."

The program, aimed at opposing labor's political dominance, is now in the planning and study stage where details of the proposed counter-offensive are being worked out.

Spearheading the overall project is hard-hitting Archie D. Gray, Gulf's senior vice president whose specialties are public and industrial relations and legal affairs.

Gray drew the battle lines himself last September.

In a crackling letter to Gulf's employes and shareholders, Gray showed he doesn't intend to pull any punches in the fight. He wrote:

"If our free, competitive institutions are to be preserved from destruction by the unholy combination of predatory gangsterism and crackpot socialism that is thriving and expanding under labor's Congressional benevolence, then business has no choice. It must do likewise, or throw in the towel." (OGJ, Sept. 15, p. 112).

**Positive action . . .** Gray, described by associates as a "fighter" who believes in "positivism, not inactivism," is laying the groundwork for a definite program.

He has two men, Paul Sheldon and Craig Thompson, making an exhaustive study of the situation and also checking on similar programs conducted by a few other companies.

Sheldon worked on the Gulf account for Young & Rubicam Advertising Agency for about 10 years. Thompson, as a freelance writer, has written several Gulf-sponsored publications. One was a company history, "Since Spindletop." The other was a myth-debunking book on oil entitled, "The Industry Nobody Knows."

**Archie D. Gray**
Ramrods Gulf project . . .

The study and planning will lead to a detailed program, which will be submitted to the Gulf management before being put into effect. Since there are no ground rules to go by, the program will have to be new and flexible.

While details of the operation are yet to be developed, the main objective is definite. It is to keep employes, stockholders, and dealers informed on governmental activities and to encourage them to take a more active interest in politics.

Public reaction to Gulf's stand has been significant. The company has received much more comment on the program than was expected and reports that "more than 99% was favorable." Gulf pointed out that announcement of its program also was welcomed by a large number of small business men.

The personable Gray is qualified to carry out the project. His associates describe him as friendly and genuine, one of the most popular men in the company. These are attributes which should help him win support for the program among the company's rank and file.

**Background . . .** Gray also has had some practical experience in politics.

Born in Franklin, Tex., he attended Texas A&M College and received his law degree from the University of Texas in 1923. Shortly after graduation from law school, Gray was elected mayor of Ennis, Tex.

He then was elected and served 4 years as district attorney in Waxahachie, Tex. He later served as assistant attorney general of Texas, in charge of oil and gas matters.

Gray became associated with Gulf's law department in Houston in 1935. In 1947 he was appointed associate general attorney for the firm and its subsidiaries. He became general counsel in 1956, was elected a vice president in April 1957, and last April was designated a senior vice president.

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## ▶▶▶ Personals

**Harold A. Kirton** has been named Gulf Coast supply-division manager for Phillips Petroleum Co.'s supply and transportation organization. He will headquarter in Houston. Kirton succeeds **Roy H. Lindsey,** who has retired.

**Hugh Q. Buck,** general counsel of Houston Oil Field Material Co. since 1941, has been named acting president of the company. He succeeds the late George O'Leary, HOMCO president since 1936 (see Deaths). A graduate of the University of Texas, Buck was at one time head of the oil and gas division in the Texas attorney general's office in Austin.

**Gordon J. McCarthy,** economics engineer with Leonard Refineries, Inc., has been named assistant manager, crude-oil and products supply. A graduate of the University of Michigan, McCarthy joined Leonard in 1950.

**Charles Kenneth Fleming** has joined Republic Oil Refining Co. as plant superintendent at the Texas City refinery. Fleming was formerly division supervisor in the coordination and economics department of American Oil Co.'s Texas City refinery. With Republic he succeeds **Mark E. Houser,** who recently joined Wilshire Oil Co. A graduate of Rice Institute, Fleming had been with American Oil since 1946.

**Jerry C. Mitchell** has joined Shell Development Co.'s Emeryville, Calif., research center as a chemist.

**John Thornburgh,** senior production engineer with Continental Oil Co., has been transferred to Fort Worth from Wichita Falls, Tex.

**John N. Gray,** formerly Eastern Venezuela district superintendent with Sinclair Venezuelan Oil Co., has formed Gray-Cochrane Corp. with **W. H. Cochrane,** Denver geological consultant. The new consulting firm will have headquarters in Denver. **Edward R. Haymaker,** formerly with Ball Associates, has joined Gray-Cochrane Corp. as reservoir-evaluation manager.

# ▶ ▶ ▶ Personals

JACKSON

**Sam L. Jackson,** transportation manager for Standard Oil Co. (Ind.), has been appointed manager of operations in the supply and transportation department. He succeeds **Richard E. Nelson, Jr.,** who was recently named president of Amoco Trading Corp., a new Indiana Standard subsidiary (OGJ, Dec. 15, p. 89). **Creed F. Gearhart,** chief engineer in the department, will succeed Jackson as transportation manager. **Lyle W. (Bill) Ewing, Jr.,** superintendent of product movement in the supply and transportation department, has been named to succeed Gearhart. Jackson has been with Indiana Standard since 1928. He was manager of products - pipeline operations before becoming transportation manager in 1956. Gearhart joined Service Pipeline Co., Indiana Standard subsidiary, in 1946. He had been chief engineer, supply and transportation department, for Indiana Standard since 1951. Ewing was assistant chief engineer before becoming superintendent of product movements. He joined the company in 1948.

**R. M. (Dick) Davis,** geological consultant, has joined Mid-America Minerals, Inc., Oklahoma City, as Rocky Mountain division manager. He will headquarter in Denver. Davis was geophysical supervisor of domestic interpretations for Carter Oil Co. before becoming a consultant.

**J. O. Scott** has been promoted to technical group leader in the production research division at Cities Service Research & Development Co.'s Tulsa laboratory. A graduate of the University of Oklahoma and University of Michigan, Scott was district editor for The Oil and Gas Journal before joining Cities Service in 1957.

Gulf Oil Corp. has changed its setup for handling of domestic market product supply. This activity will be handled through the manufacturing department. **B. R. Dorsey,** administrative vice president, will be in charge. **D. T. Parks** will head a new supply and scheduling division. **J. N. McGarvey** has been named head of a product supply section, with **Z. Q. Johnson** in charge of the refinery scheduling section. Domestic product supply for Gulf was formerly handled by a crude oil and product supply department which was also responsible for crude oil and foreign product supply.

**William K. Hayes** has joined Petroleum Chemicals, Inc., in the research division at Lake Charles, La. Also joining the staff are **Stanley D. Zimmerman** and **Jesse R. Motes.**

**Charles A Stollery,** vice president of Poole Construction Co., Ltd., and currently vice president of the Association of Professional Engineers of Alberta, has been elected a director of Royalite Oil Co., Ltd.

**Paul D. Balbin,** Chaco Petroleum, S.A., has been elected president of the newly organized Geophysical Society of Cochabamba, Bolivia. **Roger Heggblom,** Gulf Oil Corp., has been named vice president. **Joseph Keselik,** Seismograph Service Corp. of Bolivia, is secretary-treasurer. The new group plans to affiliate with both the Society of Exploration Geophysicists in the U. S. and the European Association of Exploration Geophysicists.

**Arthur M. Mouser,** assistant manager of Tidewater Oil Co.'s gas-utilization department, central and southern division, has moved up to manager. He will headquarter in Houston. He succeeds **William H. Vaughan,** who has retired. Vaughan had been with Tidewater 22 years and had been division manager of gas utilization since 1943. He will continue as a consultant to the company. A graduate of the University of Oklahoma, Mouser joined Tidewater in 1936. He was division petroleum engineer before being named assistant manager of gas utilization last year.

**Bernard M. Downey,** general manager of manufacturing operations for Shell Chemical Corp., and **George W. Huldrum, Jr.,** manager of the chemical sales division, have been elected vice presidents of the company. **George R. Monkhouse,** vice president and manager of the ammonia division in San Francisco, has been transferred to New York. **Lawrence M. Roberts,** manager of operations in the ammonia division, has been named manager. The company has formed four additional integrated divisions. **Sumner H. McAllister,** manager of the agricultural - chemical sales division, has been named manager of the new agricultural - chemical division. **Alfred W. Fleer,** general manager of manufacturing, technical, has been named manager of the new industrial chemicals division. Manager of the new plastics and resins division will be **Martin Buck,** assistant to the president. **John P. Cunningham,** manager of the synthetic-rubber sales division, will head the new synthetic-rubber division.

**H. W. Brown** will become general manager of Esso Standard (Libya) Inc. January 1. Brown was formerly assistant regional coordinator for Europe and North Africa in the producing coordination department of Standard Oil Co. (N.J.). He joined the Jersey companies in 1928 as a seismograph operator with Humble Oil & Refining Co. He switched to Carter Oil Co. in 1935 and rose to supervisor of foreign geophysical operations, assistant chief geophysicist, chief geophysicist, and exploration manager. He was elected a director of Carter in 1954. Brown left Carter to join the parent company in New York in 1956.

**E. R. Wilkinson,** head of the petroleum products department at Esso Standard Oil Co.'s Bayway refinery, Linden, N. J., has been named head of the new engineering and procurement department. **Harry Taylor,** assistant head of petroleum products, will succeed Wilkinson in that department.

**Merle R. Church,** Denver area gas manager for Shell Oil Co., will retire January 1. A graduate of Oklahoma State University, Church joined Shell in 1925. He was manager of operations in Houston before being named assistant to the regional director at Houston. He became senior mechanical engineer, gas, in 1952, and Denver area gas manager in 1954. He will do consulting work after retirement.

**Harvey H. Clare,** chief operations engineer in the engineering division for Imperial Oil, Ltd., has been appointed assistant manager of Imperial's Montreal East refinery. **A. G. Moreton,** coordinator of production planning and control for the manufacturing department in Toronto, will become chief operations engineer, engineering division, at Sarnia, Ont. In other changes, **John S. Poyen,** Calgary regional manager of the contracts and unitization department, has been named assistant manager of the Edmonton division, production department. **John S. Hamlin,** manager of the London, Ont., producing division, will succeed Poyen at Calgary. **George A. Bannantine,** London production manager, will succeed Hamlin as division manager.

# ▶ ▶ ▶ Personals

CRAM

**Ira H. Cram,** senior vice president and chairman of Continental Oil Co.'s executive committee, and **Howard H. Hinson,** vice president in charge of the foreign department, have been transferred to New York from Houston. The shift places headquarters of the foreign department in New York. **E. W. Webb,** administrative vice president in charge of the production department, has been promoted to senior vice president and given responsibility for exploration and production in the U. S. and Canada. Webb will remain in Houston. Cram joined Continental in 1949 as vice president and manager of exploration, was elected a director in 1952, senior vice president in 1953, and was made chairman of the executive committee this year. He is a director of Continental's foreign affiliates and subsidiaries. Hinson joined Conoco in 1948. He served in Ponca City, Okla., Houston, and Fort Worth before becoming vice president in charge of exploration and foreign activities in 1953. Last year he assumed his present job. Webb came to Continental in 1927. He was general production manager for the western region and manager of production before being elected a vice president in 1951.

HINSON

WEBB

**Frank M. Porter,** president of the American Petroleum Institute and of Fain-Porter Drilling Co., has been elected an advisory director of Chemical Corn Exchange Bank, New York.

**Arthur J. Heiser,** vice president of Brown Drilling Co. and International Brown Drilling Co., has been named president of the companies. He succeeds **E. C. Brown,** who will continue as chairman of both companies. A graduate of Colorado School of Mines, Heiser was a partner in Green & Heiser Drilling Co., Bakersfield, Calif., before joining Brown last year.

**Edmund A. Clement, Jr.,** exploration supervisor for Delhi-Taylor Oil Corp. in Farmington, N. M., has resigned to open consulting offices there. A graduate of the University of Oklahoma, Clement was geologist with El Paso Natural Gas Co. and with Southern Union Gas Co. before joining Delhi-Taylor in 1955.

**L. L. Handy** has been named senior research chemist in the producing technology and secondary recovery division of California Research Corp.'s La Habra, Calif., laboratory. **R. J. S. Brown** has been named senior research physicist in the well logging and basic producing research division.

**Dwight H. Smith,** geophysical party chief with Phillips Petroleum Co., has been named division geophysicist at the company's new Algiers, Algeria, office. **S. O. Eha,** foreign staff senior geologist in Bartlesville, Okla., has been named division geologist there. **D. G. Sidebottom,** formerly in Maracaibo, Venezuela, becomes Algiers office manager.

**Robert L. Maute** has been named a group leader in Monsanto Chemical Co.'s plastics division in Texas City. **N. B. Russell** has been transferred from Monsanto's Lion Oil Co. division to the Texas City plastics division. **Edgar B. Graham** has been transferred to the research department, plastics division, in Springfield, Mass. He was formerly on assignment in England. **Kenneth E. Cooley** has joined the organic chemicals division in St. Louis.

**F. T. Glasscock,** Pennant Drilling Co., Ltd., has been elected president of the Canadian Association of Oilwell Drilling Contractors. **S. W. Shambaugh,** Reading & Bates Drilling Co., has been named vice president. Newly elected directors of the association include **Peter Bawden,** Peter Bawden Drilling, Ltd.; **R. Binning,** General Petroleums of Canada, Ltd.; **R. Brinkerhoff,** Brinkerhoff Drilling Co., Ltd.; **R. Bullied,** Cascade Drilling Co., Ltd.; **Jerry D'Arcy,** Arrow Drilling Co., Ltd.; **D. Harris,** Can-Tex Drilling Co., Ltd.; **C. Nabors,** Parker Drilling Co. of Canada, Ltd.; **D. K. Seaman,** Seaman Engineering & Drilling Co., Ltd., and **J. Storey,** Precision Drilling Co. Other directors are Glasscock, Shambaugh, and **D. K. Gunderson,** Regent Drilling Co., Ltd., immediate past president of the association. Serving a second year on the board will be **H. D. Binney,** Hi-Tower Drilling Co., Ltd.; **W. B. Crutcher,** General Petroleums of Canada, Ltd.; and **R. Tull,** Canbridge Corp., Ltd.

**E. J. Theessen,** division stratigrapher with Shell Oil Co. in San Antonio, Tex., will retire December 31. He plans to open offices as consulting paleontologist in San Antonio. Theessen has been with Shell since 1935.

**Douglas Skinner,** construction superintendent for Continental Pipe Line Co. in Ponca City, Okla., has been named superintendent for Cherokee Pipe Line Co. in Wood River, Ill.

**Robert E. Old, Jr.,** has been named manager of operations in Venezuela for Stekoll Petroleum Co. Old was assistant production manager for Socony Mobil Oil Co. in Venezuela for several years. He later was assigned to Iran as a director of the consortium's refining company there. He joined Stekoll December 1.

SHEEHAN

**Edward D. Sheehan,** vice president in charge of operations for Northern Illinois Gas Co., has been elected executive vice president. He succeeds **Edgar E. Lungren,** who will retire January 1. Also, **Charles F. Henness** and **Loren W. Tuttle,** assistant vice presidents, have been named vice presidents. Henness will be in charge of divisions and Tuttle in charge of operations. Lungren had been executive vice president of the company since 1943. He will continue as a director. Sheehan became vice president in charge of operations in 1954 and a director last year.

**Charles Pence,** Humble Oil & Refining Co., has been elected 1959 president of the Gulf Coast Oil Scouts Association. Other officers are **Jack McMahan,** Magnolia Petroleum Co., first vice president; **Robert Waddell,** Tennessee Gas Transmission Co., second vice president; and **Phil Moss,** Trunkline Gas Co., secretary-treasurer.

**John L. Rankin, Jr.,** has been named manager of the Bureau of Land Management's New Orleans Outer Continental Shelf office, which supervises offshore lease sales by federal Government. Rankin, former land office manager at Denver, succeeds **Paul R. Beach,** who recently resigned. **Dale Andrus,** assistant manager of the Bureau of Land Management's Los Angeles office, will become manager of the Denver office soon after the first of the year.

**E. Waldo Emerson,** general manager of Gulf Oil Corp.'s New York sales division, will retire at the end of 1958. Emerson has been with Gulf since 1934. He was with W. H. Barber Co., the old Vacuum Oil Co., and Tidewater Oil Co. before that time. Emerson's grandfathers each founded an oil company. His maternal grandfather, R. D. Benson, was founder and first president of Tidewater. His paternal grandfather, E. O. Emerson, founded Sun Oil Co. with Joseph N. Pew.

**John E. Phillips,** formerly an independent operator, has joined N. Appleman Co. as head of the land department. Phillips was with Deep Rock Oil Corp. and Pan American Petroleum Corp. before becoming an independent.

**A. H. Meadows,** chairman of the board of General American Oil Co. of Texas and president of Fargo Oils, Ltd., has been elected a director of the Republic National Bank of Dallas. Meadows was president of General American Oil before becoming board chairman in 1950.

**Roger S. Glanville,** junior petroleum engineer with American Overseas Petroleum, Ltd. (Amoseas), has been promoted to associate petroleum engineer with Caltex Pacific Oil Co. in Sumatra. Amoseas is the exploration member of the Caltex group of companies.

**Harold B. Lawley,** senior engineer with Kewanee Oil Co., has been promoted to district engineer.

**Dr. Helmut L. Merten,** research chemist in Monsanto Chemical Co.'s organic-chemicals division at St. Louis, has been appointed a group leader in the division's research department. Merten joined Monsanto in 1955.

**H. Gardiner Symonds,** president of Tennessee Gas Transmission Co., was one of seven business leaders recently elected to the board of trustees of the Committee for Economic Development, New York economic research group.

**R. E. Scovill,** division engineer in Continental Oil Co.'s Ponca City, Okla., refinery, has been named assistant mechanical superintendent in the company's Wichita Falls, Tex., refinery. **B. D. Robertson,** mechanical engineer in Ponca City, has been named division engineer, lubricating-oil division. **W. F. Seifert,** process engineer, has been transferred to Ponca City from the Gretna, La., petrochemical plant.

**D. H. Trahan,** Shell Oil Co.'s Roswell, N. M., production superintendent, has been named senior exploitation engineer in the Midland area production department. He replaces **S. G. Stiles,** who recently was given an assignment in New York and The Hague. **S. B. Deal,** northern division production superintendent, will succeed Trahan in Roswell. **J. W. Zoller,** administrative assistant to the vice president, Midland area, will replace Deal.

## ▶▶▶ Personals

**Park Ogden,** senior geologist with Continental Oil Co., has been transferred to New Orleans from Lafayette, La.

**Paul V. Hoovler** has joined Stuarco Oil Co., Inc., as manager of the Casper, Wyo., district office. Hoovler recently resigned as Sunray Mid-Continent Oil Co. district geologist in Casper.

**James H. Galloway,** assistant manager of Humble Oil & Refining Co.'s production department, has been elected to the board of directors. Galloway joined Humble in 1930 as a petroleum engineer. He has been assistant production department manager since May 1954.

**K. T. McCamman,** division production manager for Shell Oil Co., has been transferred to Ventura, Calif., from Bakersfield, Calif. **Robert Woodward,** acting chief exploitation engineer for Shell at Midland, Tex., has been moved to Bakersfield to succeed McCamman.

**E. C. Holmer,** assistant director of the chemicals research division for Esso Research & Engineering Co., Linden, N. J., has been named manager of the production division at Jersey Production Research Co.'s Tulsa research center. He succeeds **Dr. William A. Bruce,** who has been given an assignment in the producing coordination department of Standard Oil Co. (N. J.) in New York. The appointments are effective February 1.

## ▶▶▶ Deaths

**George O'Leary,** 65, president of Houston Oil Field Material Co., died December 12 at his home in Houston. O'Leary had been president of HOMCO since 1936. He entered the oil industry with Union Oil Co. in the Pennsylvania fields soon after graduation from Duquesne University. He was with National Supply Co. and Republic Supply Co. before joining Houston Oil Field Material in 1929.

**Hu M. Harris,** 82, retired head of oil tool and rotary rig production for Humble Oil & Refining Co., died December 14 in Houston. A graduate of Purdue University, Harris joined Humble in 1928. In the early 1930's, he designed the company's first unitized draw works. He retired in 1942.

**Henry C. Brown,** 84, retired oil company foreman, died December 13 at his home in Sapulpa, Okla., after a heart attack. Brown was with the old Gypsy Oil Co. at one time and later with Cities Service Oil Co. and Gulf Oil Corp.

**Joseph F. Adams,** 65, petroleum consultant, died December 10 at his home in Wilmington, N. C. Adams entered the oil industry in 1915 as manager of Barnsdall Refining Co.'s Chicago office. He later was a vice president of Wadhams Oil Co.

**Richard Nance,** 68, Los Angeles producer, died December 4 in Los Angeles. Nance was president of Doyle Petroleum Corp. before its sale to General Petroleum Corp. He founded Tejon Hills Co. in 1948. Nance retired in 1952 when Tejon Hills was sold to Sunset International Petroleum Corp.

**John Bennett Smith,** 53, superintendent of Southern California operations for Intex Oil Co., died December 10 in Burbank, Calif.

**G. L. Townsan,** 63, accountant general for Sinclair Oil & Gas Co., died December 13 in a Tulsa hospital. He had suffered a heart attack 10 days earlier. Townsan was with American Republics Corp. before it was purchased by Sinclair in 1955.

## ▶ ▶ ▶ Statistical Section

# Gas prices limit producer's income

BY JOHN C. CASPER
Economics Editor

CRUDE is harder to find than it was 20 years ago, and finding costs are up even when corrections are made for inflation. Natural gas now represents a larger portion of total discoveries than it did in earlier years.

These two important trends are putting more pressure on the crude producer and making his job oil finding more difficult. He is not getting enough money for the energy he sells.

Natural gas competes with light and heavy heating oils made from a barrel of crude. These fuels represent about 38% of all products from crude. Since the oil operator produces both oil and gas, he tends to be his own competitor.

One result of this competition is low prices. The average producer who sells both oil and gas is receiving less money per barrel than he did in 1936.

This trend shows on the chart. To get this trend line, all natural gas has been converted to its crude equivalent on an energy basis. Average crude and gas prices at the wells are taken from reports of the Bureau of Mines. Total value of all crude and gas produced was divided by the total volume of production, expressed as its crude equivalent. This gives average price per barrel in terms of current dollars. The series was corrected for inflation by the wholesale price index for all commodities other than farm and food products.

The resulting data were plotted to show the producer's real income from an average barrel of oil and gas each year.

The average barrel of oil and gas in 1936 sold for about $1.54 in terms of 1947-49 dollars. Real prices dropped sharply in 1939 and were held at a very low level during World War II by price controls.

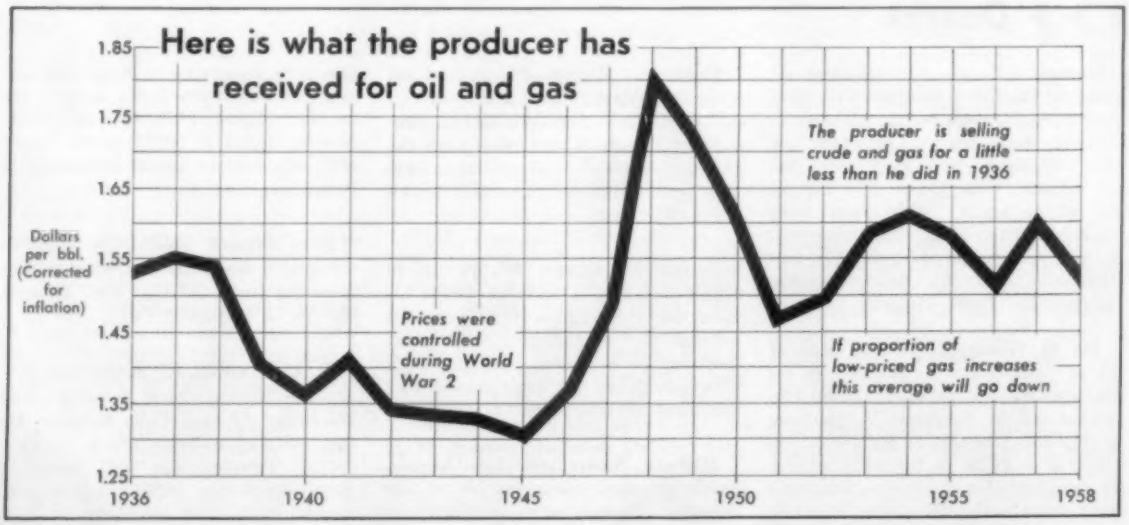
Higher demands and limited productive capacity in the years soon after the war pushed the price up to a peak of $1.80 a barrel in 1948. Inflation trimmed the average in terms of real dollars through 1951. Since that time there has been some fluctuation in real prices for crude and natural gas, but the estimate for 1958 is slightly less than the average for 1936.

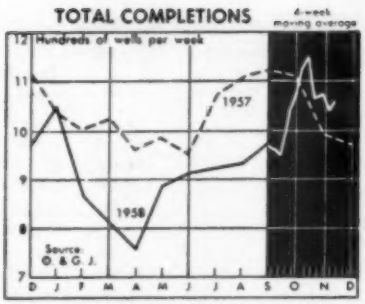
Here are three basic reasons for the low average prices in recent years. First, gas is selling for less at the well than it did in 1936, if prices are corrected for inflation. Second, a given quantity of energy in the form of gas sells for only about 20% of the price it would bring as crude oil. And last, total energy now sold by the producer contains a higher percentage of the low-priced natural gas than it did in earlier years.

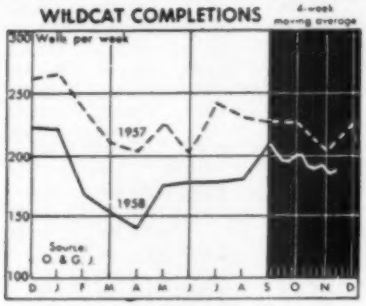
These three factors will be evaluated and charted for continued discussion on this page next week.

## A quick look at the highlights . . .

| | LATEST WEEK | Change from WEEK AGO | | Change from YEAR AGO | |
|---|---|---|---|---|---|
| Production | 7,118,075 | UP | 24,775 | UP | 205,433 |
| Crude stocks | 257,028,000 | DOWN | 1,270,000 | DOWN | 22,723,000 |
| Completions | 1,227 | UP | 238 | UP | 322 |
| Refinery runs | 7,788,000 | UP | 122,000 | UP | 14,000 |
| Gasoline stocks | 174,706,000 | UP | 401,000 | DOWN | 14,139,000 |
| Kerosine stocks | 29,647,000 | DOWN | 1,362,000 | DOWN | 257,000 |
| Distillate stocks | 148,087,000 | DOWN | 7,739,000 | DOWN | 11,188,000 |
| Residual stocks | 62,816,000 | DOWN | 2,321,000 | UP | 3,782,000 |
| Four-product stocks | 415,256,000 | DOWN | 11,021,000 | DOWN | 21,802,000 |
| Total imports | 1,609,500 | DOWN | 116,900 | UP | 249,800 |






## Active Rotary Rigs*

| | 12-15-58 | 12-8-58 | 12-16-57 |
|---|---|---|---|
| Alabama | 13 | 13 | 9 |
| Arkansas | 24 | 23 | 26 |
| Arizona | 1 | 1 | 1 |
| California | 98 | 95 | 100 |
| Colorado | 38 | 33 | 42 |
| Florida | .... | 1 | 1 |
| Georgia | .... | .... | .... |
| Illinois | 50 | 47 | 52 |
| Indiana | 8 | 5 | 11 |
| Iowa | 3 | 3 | 2 |
| Kansas | 174 | 160 | 177 |
| Kentucky | 8 | 8 | 15 |
| Louisiana | 335 | 336 | 384 |
| North | 40 | 40 | 40 |
| S.-Inland waters | 140 | 149 | (†) |
| S.-Land | 113 | 108 | 264 |
| Offshore | 42 | 39 | 80 |
| Maryland | 1 | 1 | 1 |
| Michigan | 13 | 13 | 12 |
| Missouri | 1 | 2 | .... |
| Montana | 27 | 29 | 33 |
| Mississippi | 66 | 61 | 44 |
| Nebraska | 22 | 22 | 37 |
| Nevada | .... | .... | .... |
| New Mexico | 103 | 108 | 167 |
| New York | 1 | 1 | 1 |
| North Dakota | 30 | 35 | 50 |
| Ohio | 3 | 5 | 1 |
| Oklahoma | 272 | 268 | 270 |
| Oregon | .... | .... | .... |
| Pennsylvania | 9 | 11 | 9 |
| South Dakota | .... | .... | 1 |
| Texas | 901 | 868 | 1,073 |
| S.-Inland waters | 6 | 8 | (‡) |
| S.-Land | 210 | 191 | 227 |
| Offshore | 2 | 2 | 6 |
| North-East | 179 | 182 | (†) |
| West Central | 331 | 308 | (†) |
| West | 173 | 177 | (†) |
| Utah | 38 | 37 | 56 |
| Washington | .... | .... | 1 |
| West Virginia | 1 | 2 | 2 |
| Wyoming | 81 | 86 | 74 |
| Virginia | .... | .... | .... |
| Total U. S. | 2,321 | 2,274 | 2,652 |
| Western Canada | 193 | 182 | 188 |
| Eastern Canada | 1 | 1 | 2 |
| Grand Total | 2,515 | 2,457 | 2,842 |

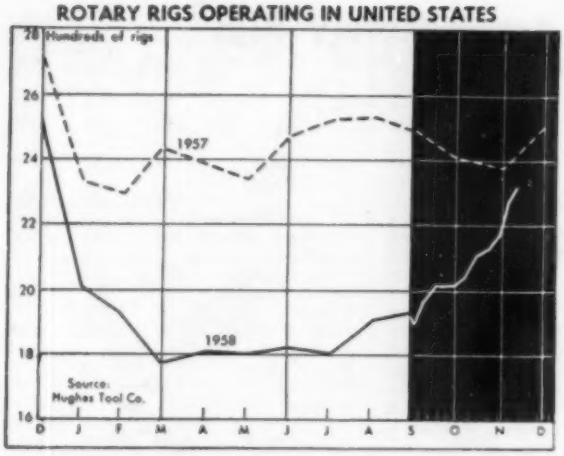
*Hughes Tool Co. †Comparisons not available due to change in method of reporting. ‡Included in South-Land.

## WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 13, 1958

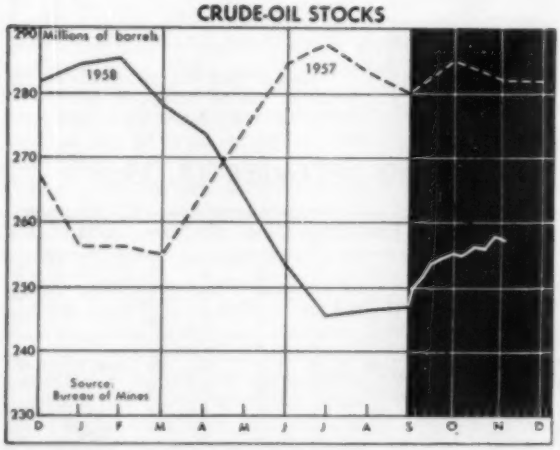
| | Total wells | | | | | | | Cumulative | | Total wildcats | | | | | Cumulative | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Crude | Cond. | Gas | Dry | Service | Footage | 1958 | 1957 | Total | Crude | Cond. | Gas | Dry | 1958 | 1957 |
| Alabama | 2 | 1 | 0 | 0 | 1 | 0 | 15,961 | 72 | 75 | 1 | 0 | 0 | 0 | 1 | 27 | 26 |
| Arkansas | 38 | 30 | 0 | 0 | 8 | 0 | 116,586 | 789 | 1,059 | 3 | 0 | 0 | 0 | 3 | 155 | 198 |
| California | 32 | 23 | 0 | 2 | 7 | 0 | 150,477 | 1,434 | 2,146 | 7 | 2 | 0 | 1 | 4 | 352 | 507 |
| Colorado | 12 | 2 | 0 | 0 | 10 | 0 | 58,739 | 806 | 821 | 7 | 2 | 0 | 0 | 5 | 465 | 530 |
| Illinois | 65 | 29 | 0 | 0 | 24 | 12 | 135,685 | 2,321 | 2,584 | 0 | 0 | 0 | 0 | 0 | 431 | 608 |
| Indiana | 22 | 10 | 0 | 0 | 12 | 0 | 39,573 | 837 | 653 | 6 | 2 | 0 | 0 | 4 | 299 | 123 |
| Kansas | 72 | 30 | 0 | 3 | 38 | 1 | 240,104 | 3,842 | 4,025 | 16 | 1 | 0 | 1 | 14 | 807 | 793 |
| Kentucky | 196 | 172 | 0 | 2 | 22 | 0 | 134,834 | 1,933 | 1,444 | 7 | 0 | 0 | 0 | 7 | 171 | 300 |
| Louisiana | 81 | 44 | 6 | 7 | 24 | 0 | 562,219 | 3,347 | 3,686 | 8 | 1 | 1 | 0 | 6 | 490 | 649 |
| North | 37 | 22 | 0 | 7 | 8 | 0 | 101,185 | 1,317 | 1,374 | 2 | 1 | 0 | 0 | 1 | 220 | 195 |
| South | 36 | 18 | 4 | 0 | 14 | 0 | 378,543 | 1,630 | 1,663 | 6 | 0 | 1 | 0 | 5 | 246 | 366 |
| Offshore | 8 | 4 | 2 | 0 | 2 | 0 | 82,491 | 400 | 649 | 0 | 0 | 0 | 0 | 0 | 24 | 88 |
| Michigan | 9 | 4 | 0 | 0 | 5 | 0 | 24,831 | 412 | 423 | 4 | 0 | 0 | 0 | 4 | 137 | 146 |
| Mississippi | 8 | 2 | 1 | 0 | 5 | 0 | 80,422 | 385 | 370 | 4 | 0 | 0 | 0 | 4 | 167 | 189 |
| Montana | 3 | 2 | 0 | 0 | 1 | 0 | 22,217 | 315 | 419 | 2 | 1 | 0 | 0 | 1 | 126 | 177 |
| Nebraska | 12 | 5 | 0 | 0 | 7 | 0 | 73,506 | 699 | 852 | 7 | 0 | 0 | 0 | 7 | 334 | 463 |
| New Mexico | 42 | 24 | 0 | 6 | 12 | 0 | 180,423 | 1,853 | 2,036 | 11 | 2 | 0 | 0 | 9 | 257 | 256 |
| West | 17 | 8 | 0 | 6 | 3 | 0 | 58,216 | 907 | 870 | 2 | 0 | 0 | 0 | 2 | 96 | 97 |
| East | 25 | 16 | 0 | 0 | 9 | 0 | 122,207 | 946 | 1,166 | 9 | 2 | 0 | 0 | 7 | 161 | 159 |
| New York | 2 | 1 | 0 | 0 | 0 | 1 | 2,471 | 503 | 499 | 0 | 0 | 0 | 0 | 0 | 44 | 11 |
| North Dakota | 12 | 5 | 0 | 0 | 7 | 0 | 59,792 | 434 | 285 | 2 | 0 | 0 | 0 | 2 | 131 | 129 |
| Ohio | 39 | 19 | 0 | 7 | 9 | 4 | 102,074 | 1,008 | 1,087 | 1 | 1 | 0 | 0 | 0 | 18 | 18 |
| Oklahoma | 134 | 76 | 0 | 10 | 41 | 7 | 483,950 | 6,042 | 5,982 | 13 | 4 | 0 | 0 | 9 | 818 | 713 |
| Pennsylvania | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 573 | 571 | 0 | 0 | 0 | 0 | 0 | 21 | 41 |
| Texas | 391 | 227 | 10 | 16 | 134 | 4 | 1,574,271 | 17,196 | 20,439 | 71 | 6 | 1 | 1 | 63 | 3,443 | 4,798 |
| Dist. 1 | 34 | 16 | 3 | 0 | 15 | 0 | 100,112 | 956 | 1,188 | 11 | 0 | 0 | 0 | 11 | 357 | 412 |
| Dist. 2 | 12 | 3 | 2 | 0 | 7 | 0 | 82,027 | 699 | 737 | 5 | 0 | 0 | 0 | 5 | 185 | 247 |
| Dist. 3 | 32 | 17 | 2 | 0 | 13 | 0 | 202,100 | 1,223 | 1,569 | 3 | 1 | 0 | 0 | 2 | 271 | 431 |
| Dist. 4 | 22 | 11 | 0 | 3 | 8 | 0 | 94,532 | 1,086 | 1,364 | 6 | 0 | 0 | 1 | 5 | 325 | 427 |
| East | 27 | 7 | 3 | 0 | 17 | 0 | 155,782 | 1,156 | 1,299 | 10 | 0 | 1 | 0 | 9 | 314 | 364 |
| Dist. 7-B | 79 | 40 | 0 | 1 | 36 | 2 | 185,957 | 2,438 | 2,779 | 11 | 0 | 0 | 0 | 11 | 657 | 935 |
| West | 112 | 90 | 0 | 1 | 19 | 2 | 501,637 | 4,907 | 5,800 | 11 | 2 | 0 | 0 | 9 | 664 | 825 |
| Dist. 9 | 49 | 30 | 0 | 2 | 17 | 0 | 163,809 | 3,464 | 4,375 | 13 | 3 | 0 | 0 | 10 | 552 | 1,049 |
| Dist. 10 | 24 | 13 | 0 | 9 | 2 | 0 | 88,315 | 1,267 | 1,328 | 1 | 0 | 0 | 0 | 1 | 118 | 108 |
| Utah | 8 | 4 | 0 | 0 | 4 | 0 | 48,378 | 369 | 254 | 1 | 0 | 0 | 0 | 1 | 78 | 122 |
| West Virginia | 20 | 1 | 0 | 19 | 0 | 0 | 55,800 | 744 | 666 | 3 | 0 | 0 | 3 | 0 | 21 | 32 |
| Wyoming | 26 | 14 | 0 | 0 | 12 | 0 | 97,246 | 728 | 827 | 11 | 2 | 0 | 0 | 9 | 249 | 291 |
| Misc. (Tenn.) | 1 | 0 | 0 | 0 | 1 | 0 | 932 | 91 | 130 | 1 | 0 | 0 | 0 | 1 | 81 | 112 |
| Total U. S. | 1,227 | 725 | 17 | 72 | 384 | 29 | 4,260,491 | 46,733 | 51,283 | 186 | 24 | 2 | 6 | 154 | 9,122 | 11,232 |
| Prev. week | 989 | 455 | 25 | 89 | 363 | 57 | 3,741,071 | ..... | ..... | 162 | 11 | 1 | 9 | 141 | ..... | ..... |
| Cum. 1958 | 46,733 | 23,106 | 1,059 | 3,509 | 17,761 | 1,298 | 188,403,664 | ..... | ..... | 9,122 | 879 | 144 | 254 | 7,845 | ..... | ..... |
| Western Canada | 38 | 22 | 0 | 3 | 13 | 0 | 180,826 | 2,346 | 2,810 | 10 | 0 | 0 | 2 | 8 | 617 | 804 |

## PRODUCTION

### ROTARY RIGS OPERATING IN UNITED STATES




### CRUDE-OIL STOCKS




### CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

| | 12-6-58 | 11-29-58 | 12-7-57 |
|---|---|---|---|
| Pennsylvania | 2,761 | 2,811 | 3,039 |
| Other Appalachian | 1,536 | 1,678 | 1,789 |
| Illinois, Indiana, Michigan | 10,684 | 10,472 | 11,131 |
| Nebraska and North Dakota | 2,348 | 2,416 | 2,986 |
| Kansas | 10,397 | 10,412 | 10,647 |
| Oklahoma | 17,102 | 17,492 | 20,874 |
| Arkansas | 2,426 | 2,283 | 2,910 |
| Louisiana | 16,939 | 17,351 | 19,868 |
| North | 2,994 | 2,963 | 3,061 |
| South | 13,945 | 14,388 | 16,807 |
| Mississippi, Alabama, Florida | 2,423 | 2,591 | 2,735 |
| New Mexico | 8,408 | 8,169 | 9,537 |
| Texas | 112,520 | 112,956 | 123,505 |
| East Texas | 8,356 | 8,053 | 8,891 |
| West Texas | 54,288 | 54,548 | 55,096 |
| Texas Gulf | 20,860 | 19,958 | 25,745 |
| Other Texas | 29,016 | 30,397 | 33,773 |
| Wyoming | 13,523 | 14,066 | 13,309 |
| Other Rocky Mountain | 9,175 | 8,967 | 6,622 |
| California | 33,158 | 32,540 | 33,772 |
| Foreign | †13,628 | 14,094 | 17,027 |
| Total | **257,028** | 258,298 | 279,751 |

*Bureau of Mines. †Includes 4,926,000 bbl. in California.

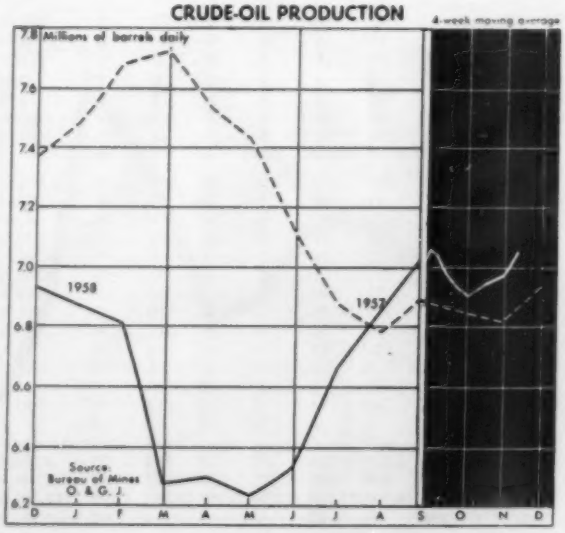
### DAILY AVERAGE PRODUCTION FOR WEEK

| | December 13, 1958 | | | Dec. 6 |
|---|---|---|---|---|
| | Crude oil | condensate | Total | total |
| Alabama | 15,800 | ..... | 15,800 | 16,400 |
| Arkansas | 80,000 | 100 | 80,100 | 80,000 |
| California | 854,400 | ..... | 854,400 | 853,400 |
| Colorado | 129,500 | ..... | 129,500 | 130,600 |
| Eastern | 43,700 | ..... | 43,700 | 45,200 |
| Florida | 1,225 | ..... | 1,225 | 1,200 |
| Illinois | 227,800 | ..... | 227,800 | 229,800 |
| Indiana | 31,600 | ..... | 31,600 | 31,500 |
| Kansas | †321,750 | ..... | †321,750 | †322,650 |
| Kentucky | 70,000 | ..... | 70,000 | 60,500 |
| Louisiana | 828,325 | 93,900 | 922,225 | 921,750 |
| North | 109,825 | 3,800 | 113,625 | 113,900 |
| South | 718,500 | 90,100 | 808,600 | 807,850 |
| Michigan | 24,500 | ..... | 24,500 | 24,300 |
| Mississippi | 114,575 | 4,875 | 119,450 | 119,775 |
| Montana | 76,900 | ..... | 76,900 | 77,300 |
| Nebraska | 59,900 | ..... | 59,900 | 59,600 |
| Nevada | 100 | ..... | 100 | 100 |
| New Mexico | 275,500 | 6,300 | 281,800 | 282,525 |
| North Dakota | 36,500 | ..... | 36,500 | 35,600 |
| Oklahoma | †548,800 | ..... | †548,800 | †559,300 |
| Texas | 2,772,000 | 66,000 | 2,838,000 | 2,810,275 |
| Dist. 1 | 45,000 | 1,450 | 46,450 | 47,025 |
| Dist. 2 | 122,000 | 8,000 | 130,000 | 128,575 |
| Dist. 3 | 381,000 | 33,000 | 414,000 | 408,275 |
| Dist. 4 | 197,000 | 7,500 | 204,500 | 204,200 |
| Dist. 5 | 31,000 | 400 | 31,400 | 31,125 |
| Dist. 6 | 121,000 | 7,300 | 128,300 | 127,725 |
| East Texas Field | 160,000 | ..... | 160,000 | 157,425 |
| Dist. 7-B | 141,000 | 100 | 141,100 | 140,250 |
| Dist. 7-C | 139,000 | 3,850 | 142,850 | 143,425 |
| Dist. 8 | 1,116,000 | 2,000 | 1,118,000 | 1,104,000 |
| Dist. 9 | 216,000 | 1,500 | 217,500 | 214,925 |
| Dist 10 | 103,000 | 900 | 103,900 | 103,325 |
| Utah | 98,100 | ..... | 98,100 | 97,400 |
| Wyoming | 335,800 | ..... | 335,800 | 334,000 |
| Others | ‡125 | ..... | ‡125 | ‡125 |
| Total U. S. | 6,946,900 | 171,175 | **7,118,075** | 7,093,300 |
| Change from previous week, up | | | **24,775** | |
| Canada | †433,600 | ..... | †433,600 | †513,292 |

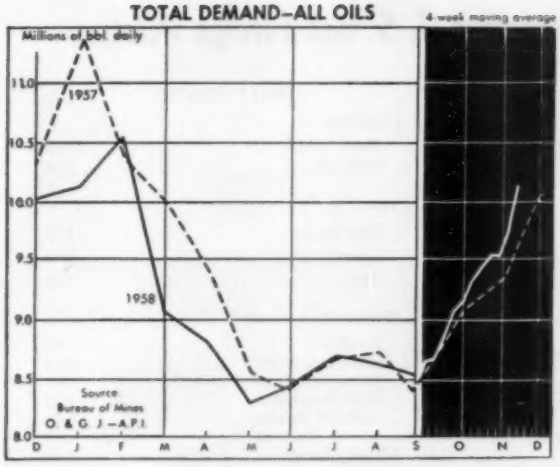
Total U. S. production, January 1-December 13 §2,311,152,400 bbl.
Same period last year (crude plus cond.) ... *2,492,846,430 bbl.

*Includes 48,868,915 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Washington. §Revised.

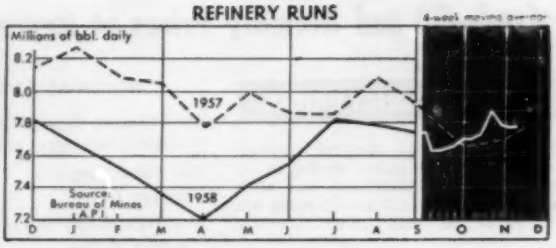
### CRUDE-OIL PRODUCTION



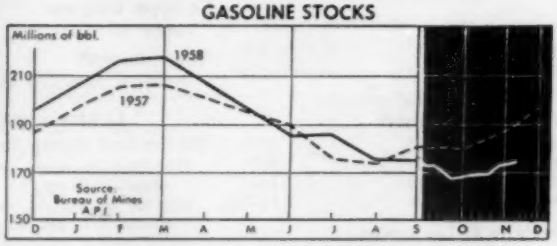
TOTAL DEMAND—ALL OILS



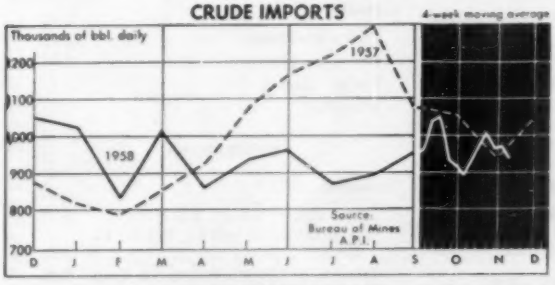

REFINERY RUNS



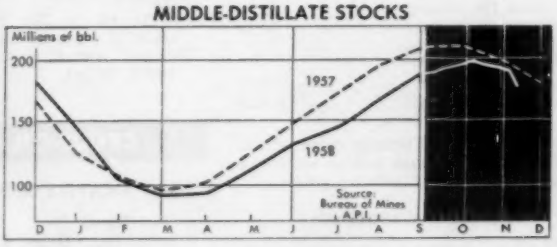

GASOLINE STOCKS



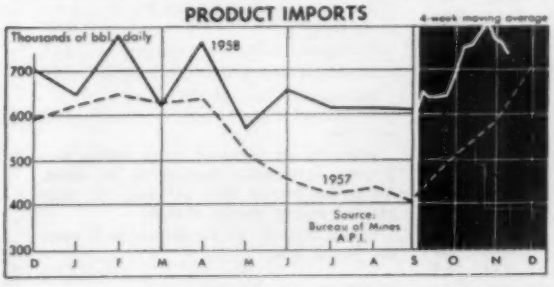

CRUDE IMPORTS



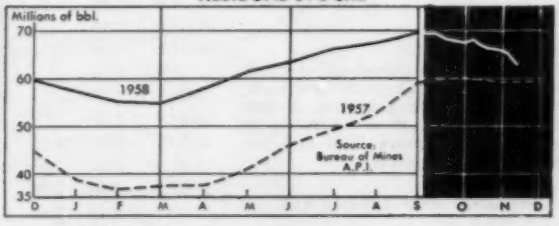

MIDDLE-DISTILLATE STOCKS




PRODUCT IMPORTS




RESIDUAL STOCKS




## API REFINERY REPORT—DECEMBER 12, 1958

(Thousands of barrels)

| District— | Daily avg. runs | Daily average production—Gaso.* | Kero. | Dist. | Resid. | Stocks‡—Gaso.† | Kero. | Dist. | Resid. | Bureau of Mines, December 1957—Daily avg. runs | Daily average production—Gaso.* | Kero. | Dist. | Resid. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East Coast | 1,154 | 546.7 | 33.6 | 421.1 | 191.2 | 41,454 | 11,959 | 54,912 | 11,528 | 1,201 | 499.9 | 38.7 | 349.4 | 194.5 |
| Appalachian: | | | | | | | | | | | | | | |
| District 1 | 105 | 39.6 | 5.0 | 1.4 | 13.4 | 4,535 | 519 | 3,335 | 311 | 108 | 44.6 | 5.4 | 24.9 | 10.8 |
| District 2 | 104 | 52.1 | 4.3 | 22.6 | 13.7 | 2,441 | 487 | 1,357 | 162 | 105 | 55.2 | 7.7 | 18.6 | 16.8 |
| Ind., Ill., Ky. | 1,393 | 713.4 | 70.8 | 327.1 | 166.7 | 30,088 | 7,107 | 27,266 | 4,835 | 1,439 | 734.1 | 83.1 | 326.7 | 218.4 |
| Minn., Wis., Dak. | 109 | 48.6 | 4.0 | 31.4 | 9.4 | 7,156 | 1,342 | 7,664 | 542 | 105 | 52.3 | 6.0 | 25.2 | 11.6 |
| Okla., Kans., Mo. | 756 | 419.1 | 14.3 | 199.3 | 23.3 | 15,977 | 1,635 | 12,112 | 976 | 731 | 415.2 | 12.6 | 202.7 | 38.6 |
| Inland Texas | 298 | 206.4 | 5.9 | 50.1 | 26.3 | 6,834 | 341 | 2,423 | 2,156 | 266 | 207.2 | 9.9 | 49.6 | 23.3 |
| Texas Gulf Coast | 1,768 | 949.9 | 143.1 | 500.9 | 176.1 | 22,944 | 3,098 | 14,124 | 6,401 | 1,807 | 906.2 | 124.9 | 489.3 | 213.4 |
| La. Gulf Coast | 680 | 316.6 | 94.7 | 117.6 | 55.7 | 10,405 | 1,882 | 6,556 | 1,843 | 599 | 351.3 | 51.2 | 149.7 | 42.7 |
| N. La. and Ark. | 86 | 34.6 | 3.0 | 21.9 | 6.3 | 4,141 | 602 | 2,285 | 118 | 95 | 38.9 | 7.5 | 20.3 | 8.0 |
| Rocky Mountain: | | | | | | | | | | | | | | |
| New Mexico | 26 | 16.0 | .... | 3.6 | 2.2 | 553 | 36 | 138 | 47 | 24 | 11.9 | 0.3 | 4.5 | 3.0 |
| Other Rky. Mt. | 270 | 133.6 | 5.6 | 66.0 | 29.3 | 4,880 | 281 | 2,918 | 970 | 256 | 126.6 | 4.0 | 63.1 | 36.2 |
| West Coast | 1,039 | 512.7 | 1.1 | 170.0 | 288.0 | 23,298 | 358 | 12,997 | 32,927 | 1,080 | 512.4 | 4.9 | 161.6 | 324.6 |
| Dec. 12, 1958 | 7,788 | 4,034.3 | 835.4 | 1,950.1 | 1,001.6 | 174,706 | 29,647 | 148,087 | 62,816 | 7,816 | 3,955.8 | 356.2 | 1,885.6 | 1,141.9 |
| Dec. 5, 1958 | 7,666 | 4,020.9 | 317.3 | 1,802.9 | 958.9 | 174,305 | 31,009 | 155,826 | 65,137 | ..... | ..... | ..... | ..... | ..... |
| Dec. 13, 1957 | 7,774 | 3,905.1 | 309.6 | 1,874.0 | 1,108.7 | 188,845 | 29,904 | 159,275 | 59,034 | ..... | ..... | ..... | ..... | ..... |

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.

# Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

## REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

### GASOLINE*

**Mid-Continent (Group 3):**

| | |
|---|---|
| Regular (89 octane) | 11.50-11.625 |
| Premium (99 octane) | 14.50-14.625 |

**Gulf Coast (cargoes for coastwise or export movements):**

| | |
|---|---|
| Regular (90 octane) | 10.25 |
| Regular (92 octane) | 10.50 |
| Premium (97 octane) | 11.625 |
| Premium (98 octane) | 11.75 |

**California (rack) (Los Angeles):**

| | |
|---|---|
| Regular (88 octane) | 12.25 |
| Premium (94 octane) | 13.25 |
| Premium (98 octane) | 14.25 |

**Caribbean area (cargoes):**

| | |
|---|---|
| Regular (87 octane) | 9.875 |
| Premium (97 octane) | 11.625 |

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

### NATURAL GASOLINE*

**Group 3:**

| | |
|---|---|
| Grade 26-70 | 4.5 |

**Breckenridge:**

| | |
|---|---|
| Grade 26-70 | 4.0 |

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

### KEROSINE AND DISTILLATE

**Mid-Continent (Group 3):**

| | |
|---|---|
| ★ Kerosine 42-44 | 10.00-10.25 |
| ★ Diesel oil (58 d.i. and above) | 9.75-10.00 |
| ★ Distillate No. 1 | 9.75-10.00 |
| ★ Distillate No. 2 | 9.00-9.25 |

**Gulf Coast (cargoes):**

| | |
|---|---|
| ★ Kerosine 41-43 | 9.625 |
| ★ Distillate No. 2 | 9.125 |

**New York Harbor (barges):**

| | |
|---|---|
| ★ Kerosine 41-43 | 11.00 |
| ★ Distillate No. 2 | 10.50 |
| ★ Diesel fuel, 48-52 d.i. | 10.75 |

**Caribbean area (cargoes):**

| | |
|---|---|
| ★ Distillate No. 2 | 8.875 |

### WAX (Lb.)

**Oklahoma (Group 3):**

| | |
|---|---|
| 132-135 A.m.p. (semi-refined) in tank car | 6.50 |

**New York (export):**

| | |
|---|---|
| 126-130 A.m.p. crude-scale (solid in bags or barrels) | 7.35 |

★Denotes change from previous week.

### RESIDUAL FUEL (BBL.)

**Mid-Continent (Group 3):**

| | |
|---|---|
| ★ Residual fuel (max. 1% S) | $1.60-1.70 |

**Gulf Coast (cargoes):**

| | |
|---|---|
| Bunker C fuel | $2.00 |

**New York Harbor (barges):**

| | |
|---|---|
| Bunker C fuel | $2.37 |

**Caribbean (cargoes):**

| | |
|---|---|
| Bunker C | $2.00 |

**California (rack):**

| | |
|---|---|
| Bunker C fuel, Los Angeles | $2.15 |

### LUBRICATING OILS

**Mid-Continent (Group 3):**

| | |
|---|---|
| 150-160 bright stock, solvent refined, 0-10 pp., 95 v.i. | 23.0 |
| 200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i. | 20.5 |

**Pennsylvania Grade:**

| | |
|---|---|
| 145-155 vis. at 210, bright stock, 8 color, 25 p.t. | 22 |
| 200 vis. neutral (180° at 100°), 25 p.t. | 21 |

## CRUDE-OIL PRICES

### GRAVITY SCHEDULE

| | Signal Hill, Calif. | Okla-homa* | Gulf Coast Tex.† | West Tex.‡ N.M. | Wyo. (sour) |
|---|---|---|---|---|---|
| 14-14.9 | $1.86 | .... | .... | .... | .... |
| 15-15.9 | 1.95 | .... | .... | .... | $1.81 |
| 16-16.9 | 2.04 | .... | .... | .... | 1.86 |
| 17-17.9 | 2.13 | .... | .... | .... | 1.91 |
| 18-18.9 | 2.23 | .... | .... | .... | 1.96 |
| 19-19.9 | 2.32 | .... | .... | .... | 2.01 |
| 20-20.9 | 2.41 | $2.52 | .... | $2.62 | 2.06 |
| 21-21.9 | 2.50 | 2.55 | .... | 2.64 | 2.11 |
| 22-22.9 | 2.60 | 2.58 | .... | 2.66 | 2.16 |
| 23-23.9 | 2.69 | 2.61 | $3.44 | 2.68 | 2.21 |
| 24-24.9 | 2.78 | 2.64 | 3.46 | 2.70 | 2.26 |
| 25-25.9 | 2.87 | 2.67 | 3.48 | 2.72 | 2.31 |
| 26-26.9 | 2.96 | 2.70 | 3.50 | 2.74 | 2.36 |
| 27-27.9 | 3.06 | 2.73 | 3.52 | 2.76 | 2.49 |
| 28-28.9 | 3.11 | 2.76 | 3.54 | 2.78 | 2.54 |
| 29-29.9 | 3.16 | 2.79 | 3.56 | 2.80 | 2.59 |
| 30-30.9 | 3.22 | 2.82 | .... | 2.82 | 2.63 |
| 31-31.9 | 3.27 | 2.85 | .... | 2.84 | 2.67 |
| 32-32.9 | 3.33 | 2.88 | .... | 2.86 | 2.71 |
| 33-33.9 | 3.38 | 2.91 | .... | 2.88 | 2.75 |
| 34-34.9 | 3.44 | 2.94 | .... | 2.90 | 2.79 |
| 35-35.9 | 3.49 | 2.97 | .... | 2.92 | 2.83 |
| 36-36.9 | 3.55 | 3.00 | .... | 2.94 | 2.87 |
| 37-37.9 | 3.60 | 3.02 | .... | 2.96 | 2.89 |
| 38-38.9 | .... | 3.04 | .... | 2.98 | 2.91 |
| 39-39.9 | .... | 3.06 | .... | 3.00 | 2.93 |
| 40-44.9 | .... | 3.08 | .... | 3.02 | 2.95 |

*Top prices on other Oklahoma (sweet) postings vary from $3.15 to $3.01 a barrel. †Low cold test crude. ‡Sour.

Effective dates of broad changes: California, 9-30-58: East of California, January 3-10, 1957; Pennsylvania Grade, 6-18-58.

### FLAT PRICES

**Louisiana:**

| | |
|---|---|
| Sweet Lake | $3.00 |
| Ville Platte | 3.30 |

**Texas:**

| | |
|---|---|
| East Texas | 3.25 |
| Conroe | 3.53 |
| Van | 3.08 |

**Pennsylvania Grade:**

| | |
|---|---|
| Bradford | 3.90 |
| Middle District | 3.72 |
| Southwest Pennsylvania | 3.43 |
| West Virginia | 3.25 |
| Buckeye Grade | 3.25 |

| | |
|---|---|
| **Illinois Basin** | 3.00 |

**Canada:**

| | |
|---|---|
| Leduc-Woodbend | 2.67 |
| Redwater (Alta.) | 2.56 |
| Smiley (Sask.) | 2.33 |
| Pembina | 2.52 |

### FOREIGN

**Venezuela:**

| | |
|---|---|
| Cumarebo, 48°-49.9°, Tucupido | 3.66 |
| San Joaquin, 41°-41.9°, Puerto La Cruz | 3.25 |
| Oficina, 35°-35.9°, Puerto La Cruz | 3.05 |
| Tia Juana medium, 26°-26.9°, Amuay* | 2.55 |
| Quiriquire, 16.0°-16.4°, Caripito | 2.15 |
| Lagunillas heavy, flat, Las Piedras* | 2.10 |
| Bachequero, flat, 15°-16°, Las Piedras* | 1.93 |

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

**Middle East, Persian Gulf (cargoes, f.o.b. lifting port):**

| | |
|---|---|
| Arabian, 36.0°-36.9°, Ras Tanura | $2.12 |
| Iranian, 34.0°-34.9°, Bandar Masur | 2.04 |
| Iranian, 34.0°-34.9°, Ababan | 1.99 |
| Iraq, 35.0°-35.9°, Fao | 1.98 |
| Kuwait, 31.0°-31.9°, Mina-al-Ahmadi | 1.85 |
| Qatar, 41.0°-41.9°, Umm Said | 2.23 |

**Middle East, E. Mediterranean:**

| | |
|---|---|
| Arabian, 36.0°-36.9°, Sidon | 2.49 |
| Iraq, 36.0°-36.9°, Tripoli, Banias | 2.49 |

**Far East (cargoes, f.o.b. Lutong, Sarawak):**

| | |
|---|---|
| Seria Light, 37° | 2.75 |

### TANKER RATES PER LONG TON

(Latest reported spot fixtures)

| | |
|---|---|
| ★ Gulf-U.S.N.H., clean (USMC+10%) | $3.14 |
| Gulf-U.S.N.H., dirty (ATRS—25%) | 2.14 |
| ★ Carib.-U.S.N.H., dirty (USMC —47.5%) | 1.42 |
| ★ P.G.-U.S.N.H., dirty (USMC—70%) | 3.81 |

# November wildcat depth breakdown

| | OIL DISCOVERIES | | | | | | | | | GAS DISCOVERIES | | | | | | | | | DRY HOLES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | A | B | C | D | E | F | G | H | I | A | B | C | D | E | F | G | H | I |
| Alabama | | | | | | | | | | | | | | | | | | | | 1 | | | | 1 | | | |
| Alaska | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | |
| Arizona | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | |
| Arkansas | | | | | | | | | | | | | | | | | | | | | 7 | 1 | 2 | | | | |
| California | | | | | | 2 | 1 | | | | | | | | | | | | | 3 | 3 | 9 | 5 | 2 | 1 | | |
| Colorado | | | | | | | | | | | | | 2 | 1 | 1 | | | | 3 | 6 | 2 | 9 | 16 | 1 | | | |
| Illinois | | 2 | | | | | | | | 2 | | | | | | | | | 9 | 19 | 10 | 1 | | | | | |
| Indiana | 3 | 3 | 1 | | | | | | | | | | | | | | | | 9 | 14 | 2 | | | | | | |
| Kansas | | 2 | 3 | 8 | 1 | | | | | | | 1 | | | | | | | 2 | 7 | 43 | 30 | 2 | | | | |
| Kentucky | 1 | 2 | 1 | | | | | | | | | | | | | | | | | 11 | 1 | | | | | | |
| Louisiana | | | 1 | | | | | | | | | 1 | | | | | | | 2 | 1 | 8 | 2 | 5 | 6 | 5 | 3 | 3 |
| North | | | 1 | | | | | | | | | 1 | | | | | | | 2 | 1 | 8 | 2 | 4 | 3 | 1 | | |
| South | | | | | | | | | | | | | | | | | | | | | | | 1 | 3 | 4 | 3 | 3 |
| Offshore | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Michigan | | 2 | | 1 | | | | | | | 1 | | | | | | | | | 1 | 4 | 1 | | | | | |
| Mississippi | | | | | | | | 1 | | | | | | | | | | | | | | 1 | 6 | 2 | | 1 | |
| Montana | | | | | | | | | | | | | | | | | | | | | 3 | 2 | 2 | 1 | 1 | | |
| Nebraska | | | | | 8 | | | | | | | | | | | | | | | | 1 | 8 | 21 | | | | |
| New Mexico | | | | | 1 | | 1 | | | | | | | | | | | 1 | 1 | 5 | 8 | 2 | 3 | | 1 | 1 | |
| West | | | | | | | | | | | | | | | | | | | 1 | 1 | 1 | 1 | | | | | |
| East | | | | | 1 | | 1 | | | | | | | | | | | 1 | | 4 | 7 | 1 | 3 | | 1 | 1 | |
| New York | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | |
| North Dakota | | | | | | | | | | | | | | | | | | | | | 2 | 1 | 2 | 1 | | | |
| Ohio | | | | 2 | | | | | | | | 1 | 1 | | | | | | | | 1 | 2 | | | | | |
| Oklahoma | | | 2 | 2 | 3 | 4 | | | 1 | | | | 2 | | 1 | | | | 6 | 8 | 14 | 5 | 14 | 6 | 3 | 1 | |
| Pennsylvania | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | |
| South Dakota | | | | | | | | | | | | | | | | | | | 1 | 2 | | | | | | | |
| Tennessee | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | | | | |
| Texas | | 2 | 1 | 2 | 5 | 2 | 2 | | | | | 1 | 1 | | | | | 1 | 24 | 74 | 38 | 41 | 62 | 30 | 5 | | |
| Dist. 1 | | 1 | | | | | | | | | | 1 | | | | | | | 3 | 5 | 4 | 3 | 1 | | | | |
| Dist. 2 | | | | | | 1 | | | | | | | | | | | | | | 1 | 2 | 2 | 2 | 5 | 2 | | |
| Dist. 3 | | | | | | | | | | | | | | | | | | | | | | 2 | 6 | 13 | 1 | | |
| Dist. 4 | | | | | | 1 | | | | | | | | | | | | | 2 | 4 | 1 | 1 | 4 | 3 | 2 | | |
| East | | | | | | | | | | | | | | | | | | | | 1 | 1 | 6 | 13 | 3 | | | |
| Dist 7-B | | | | | 2 | | | | | | | | 1 | | | | | | 13 | 39 | 11 | 8 | 4 | | | | |
| West | | 1 | | 1 | 1 | | 2 | | | | | | | | | | | 1 | 3 | 6 | 5 | 14 | 16 | 2 | | | |
| Dist. 9 | | | 1 | 1 | 2 | | | | | | | | | | | | | | 3 | 18 | 12 | 4 | 14 | | | | |
| Dist. 10 | | | | | | | | | | | | | | | | | | | | | 2 | 1 | 2 | 4 | | | |
| Utah | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | |
| Washington | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | |
| West Virginia | | | | | | | | | | | | | 2 | | | | | | | | | | | 1 | | | |
| Wyoming | | | | 1 | | | | | | | | | | 2 | | | | | 11 | 1 | 3 | 2 | 6 | 2 | 1 | 1 | |
| **Total United States** | **4** | **13** | **9** | **16** | **18** | **8** | **4** | **1** | **1** | **2** | **1** | **4** | **8** | **3** | **4** | | | **2** | **70** | **154** | **153** | **118** | **148** | **53** | **18** | **7** | **3** |
| Western Canada | | 1 | | 3 | 1 | 2 | | | | | | | 2 | 1 | | | | | | 5 | 6 | 12 | 9 | 1 | 2 | | 1 |
| Alberta | | | | | | 2 | | | | | | | 2 | | | | | | | 1 | 2 | 6 | 4 | 1 | 2 | | 1 |
| Saskatchewan | | 1 | | 3 | 1 | | | | | | | | | | | | | | | 3 | 4 | 4 | 2 | | | | |
| Manitoba | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| British Columbia | | | | | | | | | | | | | | 1 | | | | | | 1 | | 2 | 3 | | | | |

NOTE: A = 0-1,250 ft.; B = 1,250-2,500 ft.; C = 2,500-3,750 ft.; D = 3,750-5,000 ft.; E = 5,000-7,500 ft.; F = 7,500-10,000 ft.; G = 10,000-12,500 ft.; H = 12,500-15,000 ft.; I = 15,000 ft.

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GENERAL SALES MANAGER wanted by aggressive petroleum marketing company with headquarters in Tulsa. Must be experienced in sales promotion, well known in the industry and have full knowledge of specifications of petroleum products as well as pricing schedules. Some traveling necessary. Excellent opportunity with chances for advancement for right man. Please reply Box K-855, The Oil and Gas Journal, Tulsa, Oklahoma, giving age, qualifications, references and expected starting salary. All replies will be treated strictly confidential.

## SITUATION WANTED

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PETROLEUM ENGINEER, Texas Registered, B.S. Univ. of Oklahoma, 37, family, 10 years with same drilling contractor, past 2 years as manager. Experienced in mud, air and foam drilling. Desire to contact small West Texas contractor or independent wanting to purchase rig or expand. Excellent references. Box L-106, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM GEOLOGIST: with experience in many oil provinces during a period of more than thirty years in the Oil Industry desires connection as Geologist either with Oil Loan Department of bank or on retainer basis with aggressive independent operator. Will furnish excellent references. Box L-107, The Oil and Gas Journal, Tulsa, Oklahoma.

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HAVE 15-20 BARREL wildcat well—A-1 equipment—new 7" casing—more pay perforated—needs frac job. Located on 900 acre block in Luling area on good faulting. Good possibilities in Eagleford, Buda and Edwards formations. Owner will sell one-fourth to one-half interest in well and block. Box 28, Seguin, Texas.

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**LEGAL**

SEALED BIDS will be received until 10:00 A.M. Mountain Standard Time, January 13, 1959, and opened at that time in the office of the Navajo Indian Agency, Window Rock, Arizona, for oil and gas leases, on 45 tracts of tribal lands, totaling approximately 102,690.32 acres, located in San Juan County, New Mexico. Details of the lease offering and filing of bids may be obtained by addressing an inquiry to the General Superintendent, Navajo Indian Agency, Attention: Branch of Realty, Window Rock, Arizona.


## Michigan's Scipio field stretches

EXPANSION of Scipio field to the south and possibly on the northeast can result from three Don Davis drilled tests. Davis' 1 Domack, 14-3s-5w, flowed 190 bbl. on plunger lift first day tested in Trenton. Davis staked location ½ mile farther south.

## New books for oil finders

THE Oklahoma Geological Survey, Norman, has published a new bulletin, No. 82, entitled "Stratigraphy and Paleontology of the Hunton group in the Arbuckle Mountain Region," Part V-Bois d'Arc Articulate Brachiopods, by Thomas W. Amsden.

According to Carl C. Branson, director of the survey, the present volume records the results of further research by Dr. Amsden on the Hunton group. These rocks are oil-bearing at many places and this careful detailed examination of the lithologies and of the unconformities within the group, detectable only by expert use of fossils, is certain to aid in exploration for oil and gas.

This is a first-rate series on the Hunton group. These rocks and their excellent fossils are famous throughout the world and are now, through Dr. Amsden's studies, as thoroughly known as any comparable geologic unit and fauna in the world.

Price of the bulletin is $1.50 paper, $2.25 bound.

## Meetings for oil finders

EL PASO has been chosen as the site for the twelfth annual midwestern exploration meting which will be held April 27 and 28, 1959, it has been announced by general chairman Decker Dawson, of Dawson Geophysical Co., Midland, Tex.

Headquarters will be at Hotel Cortez, Dawson said, and the technical sessions will also be held there.

This meeting of oil-exploration scientists is jointly sponsored by geological and geophysical societies in Dallas, Fort Worth, Midland, Shreveport, Oklahoma City and Tulsa. Dawson said its purpose is to get geophysicists and geologists of this region together for solving the complex problems that confront both groups while hunting for oil in the Midwest area.

Host for the 1959 meeting is the Permian Basin Geophysical Society, the Midland section of the SEG.

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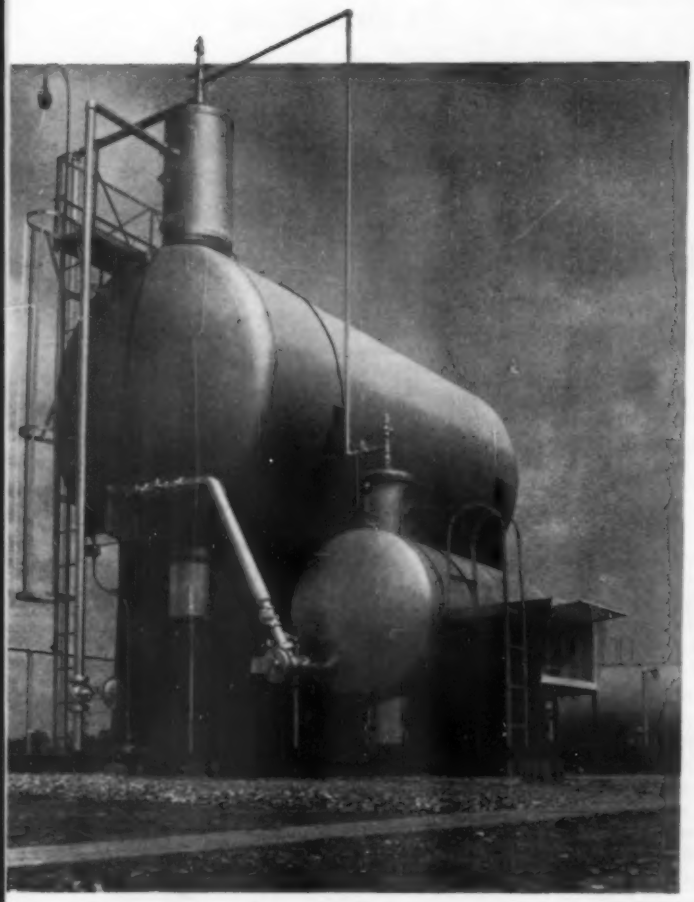

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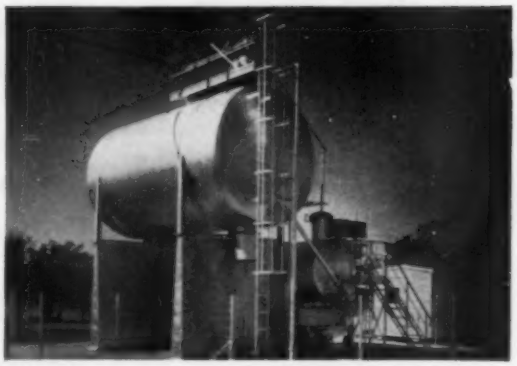

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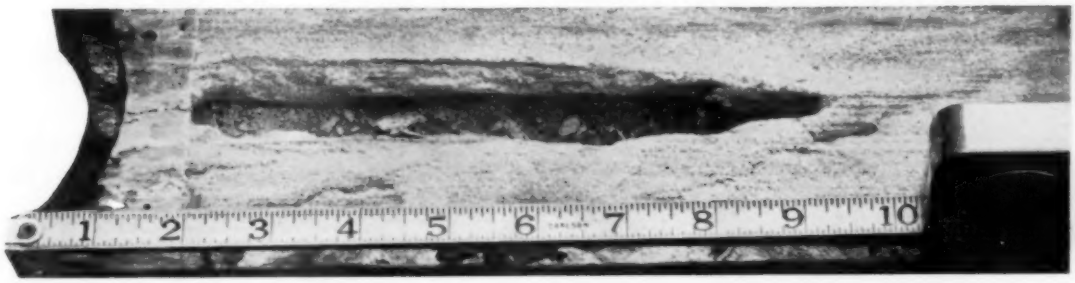


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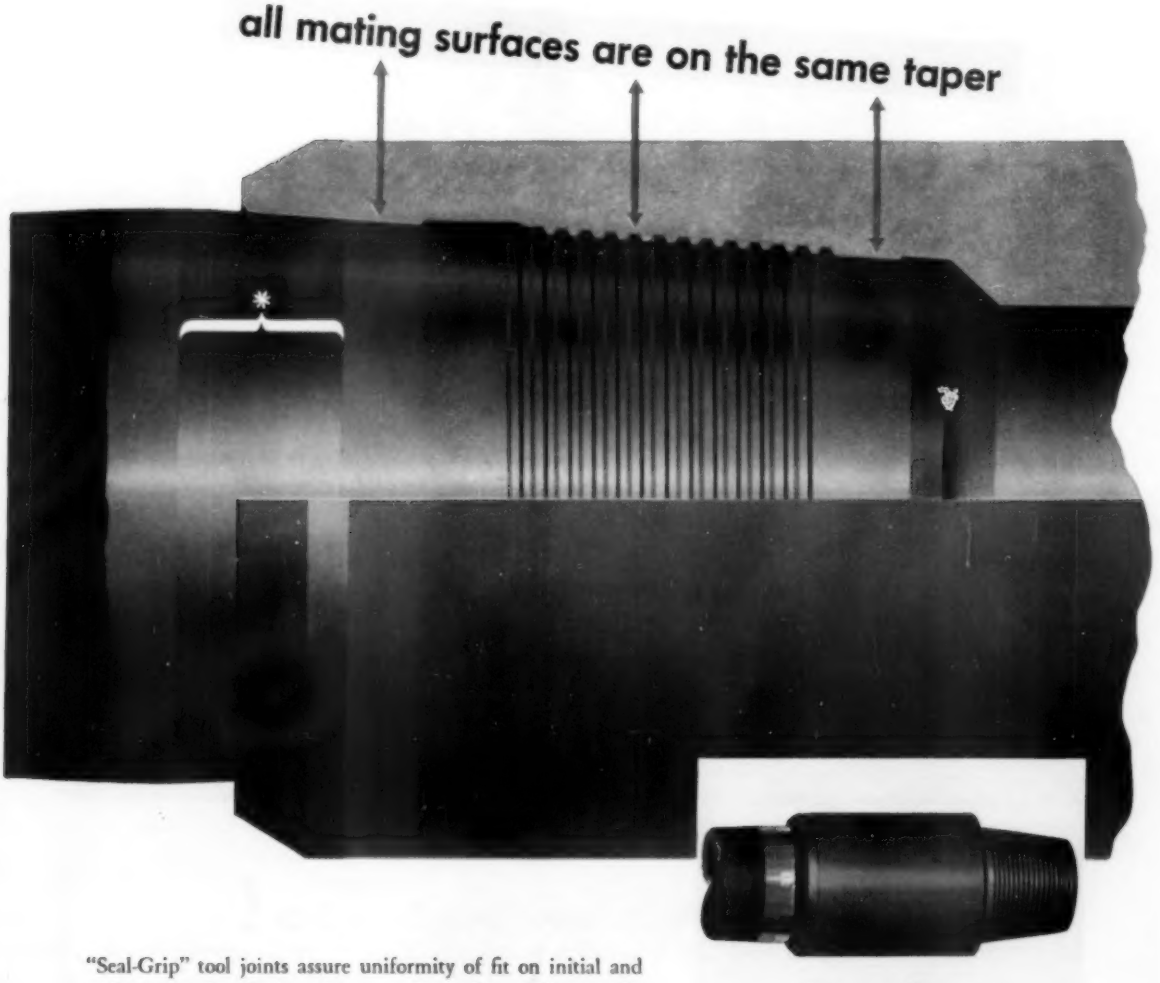


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